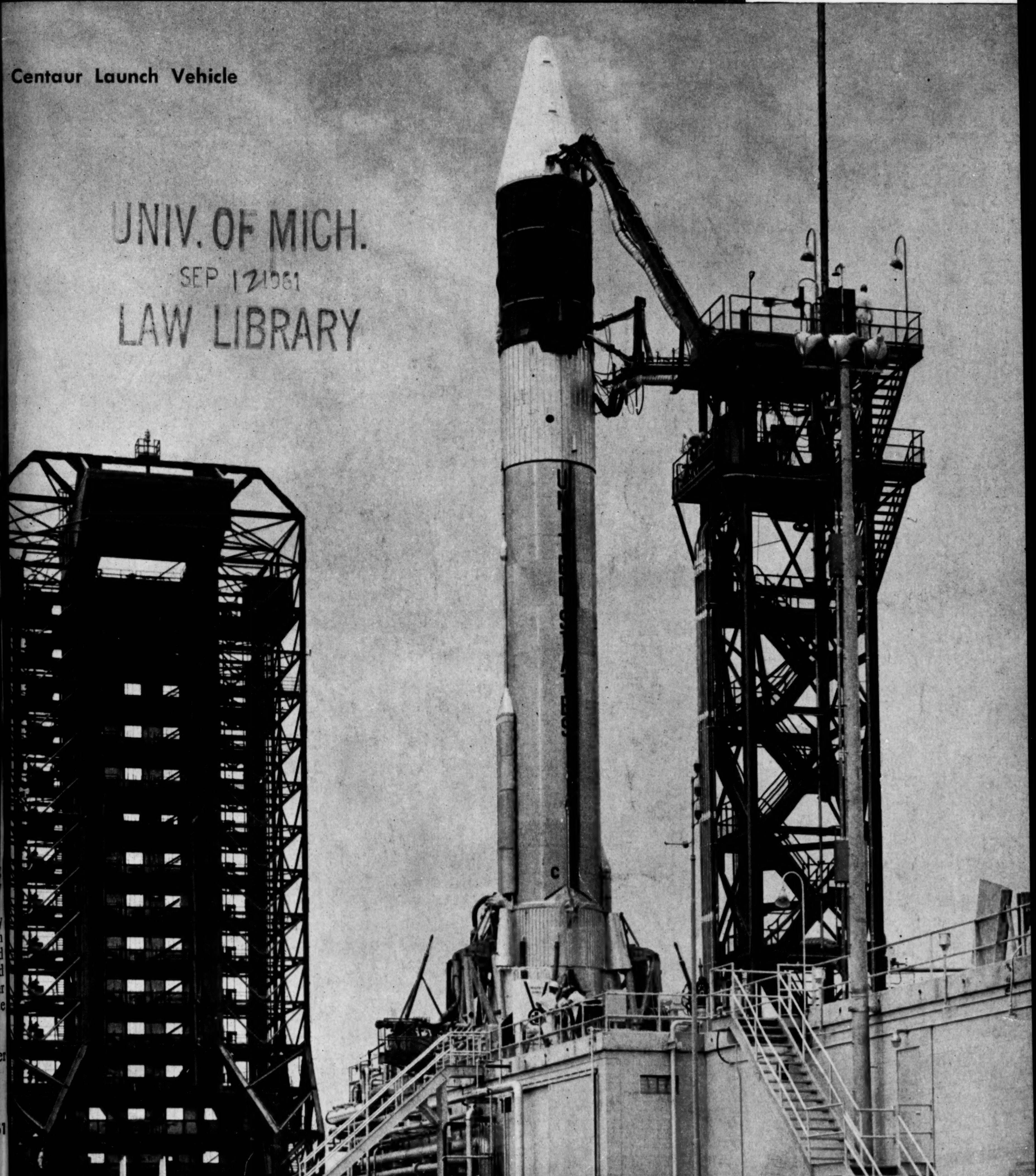
Aviation Week and Space Technology

September 11, 1961

RR

SPECIAL REPORT:

Farnborough Air Show



Centaur Launch Vehicle

UNIV. OF MICH.
SEP 12 1961
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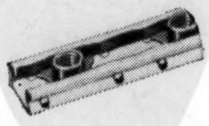
All-metal anchor nut

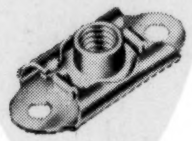
1951

Narrow gang channel



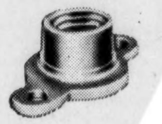
1952

Narrow
floating anchor nut



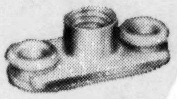
1953

Miniature anchor nut



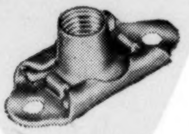
1954

Miniature
floating anchor nut



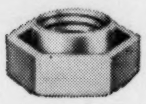
1955

Deep counterbore
floating anchor nut



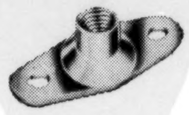
1956

Internal / External
wrenching hex nut



1956

A 286 Cres anchor
nut and hex nut



1956

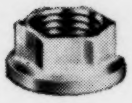
Complete line of
NAS lowheight nuts

1957

High-tensile
12 pt. nut

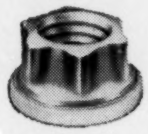
1957

Reduced height
6 point nut



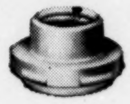
1958

Captive
washer hex nut



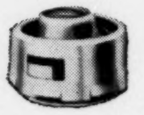
1959

Miniature stake nut



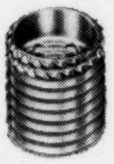
1960

Miniature
floating stake nut



1960

Thin wall,
high strength insert



1960

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AVIATION CALENDAR

Sept. 20-24—National Convention and Aerospace Panorama, Air Force Assn., Philadelphia, Pa.

Sept. 26-28—Annual Convention, National Business Aircraft Assn., Mayo Hotel, Tulsa, Okla.

Sept. 29-30—Society of Experimental Test Pilots' Fifth Annual Symposium and Awards Banquet, Beverly-Hilton Hotel, Beverly Hills, Calif.

Oct. 2-4—Seventh National Communications Symposium, Institute of Radio Engineers, Hotel Utica, Utica, N. Y.

Oct. 2-5—Annual Meeting, Meteorological Committee, Air Transport Assn., Casa Munras Hotel, Monterey, Calif.

Oct. 2-7—12th International Astronautical Congress, Washington, D. C.

Oct. 3-5—National Airports Conference, University of Oklahoma, Norman, Okla.

Oct. 4-6—Semi-Annual Convention, American Society of Photogrammetry, Biltmore Hotel, New York, N. Y.

Oct. 5—International Airline Navigators Council, Pacific Regional Meeting, Hotel Drake Wiltshire, San Francisco, Calif.

Oct. 9-11—Mid-Year Conference, Airport Operators Council, Hilton Hotel, El Paso.

Oct. 9-11—National Electronics Conference, International Amphitheatre, Chicago, Ill.

Oct. 9-13—National Aerospace Engineering & Manufacturing Meeting, Society of Automotive Engineers, Ambassador Hotel, Los Angeles, Calif.

Oct. 9-15—American Rocket Society's 16th Annual Meeting & Space Flight Report

(Continued on page 6)

AVIATION WEEK and Space Technology

September 11, 1961

Vol. 75, No. 11

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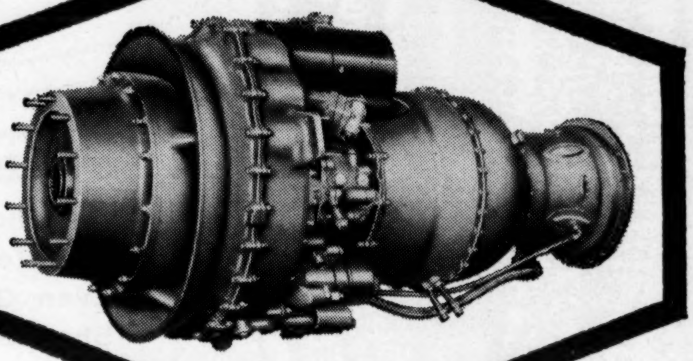

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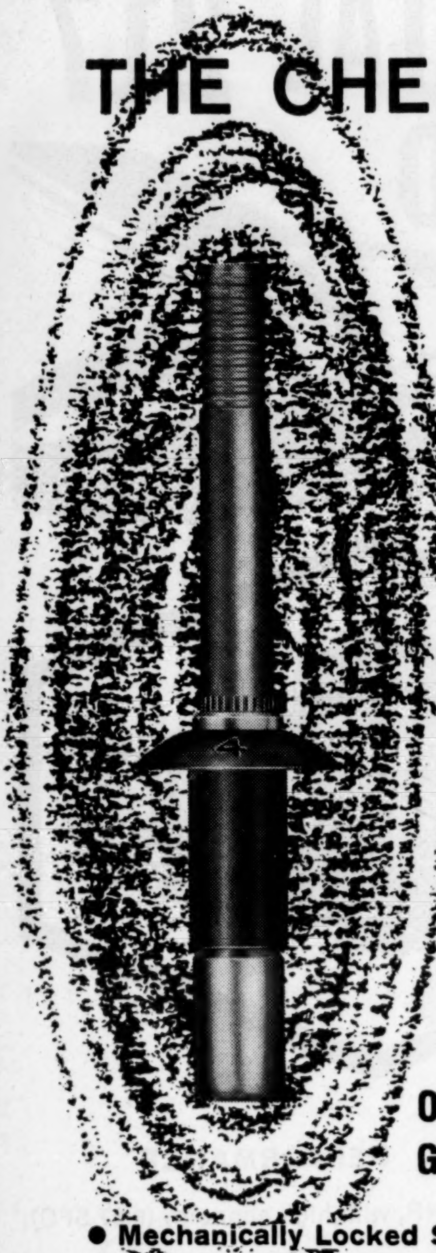

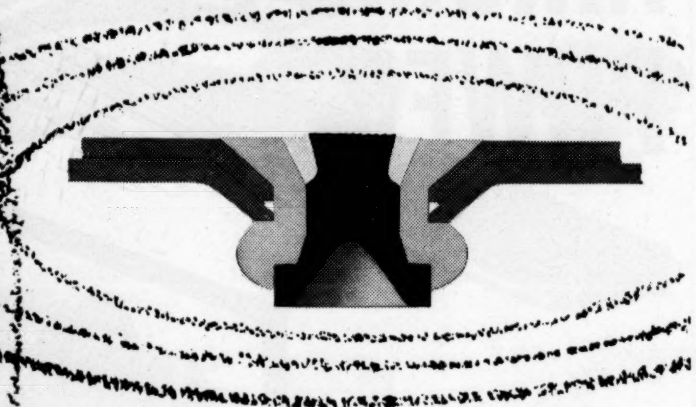

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AVIATION CALENDAR

(*Continued from page 5*)

to the Nation, Coliseum, New York, N.Y.

Oct. 9-15—Aircraft Owners & Pilots Assn. Convention, St. Petersburg, Fla.

Oct. 10-12—Second Conference on Nuclear Reactor Chemistry and Fifth Conference on Analytical Chemistry in Nuclear Reactor Technology, Gatlinburg, Tenn. Sponsor: Oak Ridge National Laboratory.

Oct. 14-22—Federation Aeronautique Internationale 1961 General Conference, Hotel Quintandinha, Rio de Janeiro, Brazil.

Oct. 16-19—Eighth Annual Symposium, American Vacuum Society, and Second International Congress, International Organization for Vacuum Science and Technology, Sheraton-Park Hotel, Washington, D. C.

Oct. 19—General Aviation Safety Committee, National Safety Council, Conrad Hilton Hotel, Chicago, Ill.

Oct. 23-24—Joint Meeting, Canadian Aeronautical Institute/Institute of the Aerospace Sciences, Ottawa, Canada.

Oct. 23-24—International Airline Navigators Council, European Regional Meeting, Paris, France.

Oct. 23-25—East Coast Conference on Aerospace and Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

Oct. 23-27—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.

Oct. 23-Nov. 3—William Tell 1961, USAF Interceptor Weapons Meet, Tyndall AFB, Fla. Host: Air Defense Command.

Oct. 24-26—Air Traffic Conference, Air Transport Assn., Marriott Twin Bridges Motor Hotel, Washington, D. C.

Oct. 24-26—International Symposium on Aero-Space Nuclear Propulsion, IRE, Riviera Hotel, Las Vegas, Nev.

Oct. 24-26—Air Transport Assn.'s Engineering and Maintenance Operators Meeting, Americana Hotel, Miami Beach, Fla.

Oct. 26-27—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Sahara Hotel, Las Vegas, Nev.

Oct. 26-27—Third Annual Symposium on High-Speed Testing, Hotel Somerset, Boston, Mass. Sponsor: Plas-Tech Equipment Corp.

Oct. 30-Nov. 1—Annual Meeting, Air Traffic Control Assn., Deauville Hotel, Miami Beach, Fla.

Nov. 1-3—"Issues and Challenges of Air Transportation" Symposium, Hartford, Conn. Sponsor: Connecticut General Life Insurance Co.

Nov. 6-8—Special Technical Conference on Non-Linear Magnetics, Institute of Radio Engineers, Statler Hilton Hotel, Los Angeles, Calif.

Nov. 6-9—1961 Conference and AtomFair, Atomic Industrial Forum and American Nuclear Society, Conrad Hilton Hotel, Chicago, Ill.

Nov. 9-10—Fifth Annual Display, Aerospace Electrical Society of San Diego, Balboa Park, San Diego, Calif.

Nov. 28-30—38th Meeting, Aviation Distributors and Manufacturers Assn., Jung Hotel, New Orleans, La.

Dec. 5-7—Annual Convention, National Aviation Trades Assn., Statler Hilton Hotel, Washington, D. C.

September 11, 1961

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and Space Technology

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EDITORIAL

The Military Space Role—I

There has been growing concern lately over the role assigned to the military in the U. S. national space program. Such widely diverse spokesmen as Sen. John Stennis (D.-Miss.), Dr. Walter Dornberger, former commander of the German Peenemunde development center and now vice president of Bell Aerosystems Co., and Robert Seamans, associate administrator of the National Aeronautics and Space Administration, have voiced public concern over the current neglect of military aspects of the U. S. space program. Within the Air Force, assigned primary military space responsibility within the Department of Defense, a belated recognition of the current and future importance of military capabilities is glimmering among the top USAF brass, although research-minded younger officers have been hammering this theme since well before Sputnik I.

Much of this current concern with the military space potential has been stimulated by the successful Soviet orbital flights of Majors Gagarin and Titov. It is now becoming increasingly apparent that the earlier diagnosis of U. S. military space analysts that the Soviet space program was an effort primarily oriented toward military goals is essentially correct. Even the Soviets themselves have dropped their cloak of peaceful science and are beginning to brandish their growing military space capability with the same bluster with which they have rattled rockets for the past few years.

Although the few voices raised against this policy were hardly heard at the highest government councils of a few years ago, it is now apparent that one of the worst policy decisions of the past decade was to try to label our national space program with the catchword of "peace" and to interpret this as effective exclusion of the military from any significant participation in the basic organization of the space research program and determination of its objectives. This decision stripped the military of much of the development work it was already doing in space such as large rocket boosters, bioastronautics and satellite systems development and put this effort completely under the civil—and according to the language of that day—the necessarily "peaceful" tent of NASA.

Excluding the Military

This decision to reduce the military to a support role in the basic national space program was conditioned by two premises that have since proved to be false. The first was that at least a decade of space research would be required before any practical applications in the form of operational systems would be possible. The experience of only a few years of exploratory post-Sputnik research has underlined the gross error of this estimate and a wide variety of operational space systems, both civil and military, have already been proved technically feasible.

The second was that we would score a great moral propaganda victory by hanging the "peace" label on our space program. We went to some ridiculous lengths to try to achieve this goal including putting the Mercury astronauts in sack suits and ignoring their military titles. Again experience has proved that the Soviets' more spectacular efforts have monopolized the international propaganda spotlight even though their astronauts were given military promotions in orbit and wore the Red Air Force uniform to have tea with the Queen of England and on visits to the Western Hemisphere. One of the most significant shots in a recent Soviet documentary film on their manned orbital achievements shows Maj. Titov bidding farewell to the technical architects of his space system just before takeoff. In the lineup, the large majority of these space technologists were in Red Air Force uniform.

The U. S. decision, taken during the fading years of the Eisenhower Administration, reversed the pattern of previous technical development success in the areas of aeronautics and nuclear fission, where we achieved a clear-cut international leadership for significant time periods. In both these fields the military requirements were given top priority to achieve technical superiority in weapons development on which our international posture depended. As an enormous dividend from the investment in the technical exploration of these areas, the new technology flowed into myriad civil applications albeit at a more leisurely pace than the military effort required.

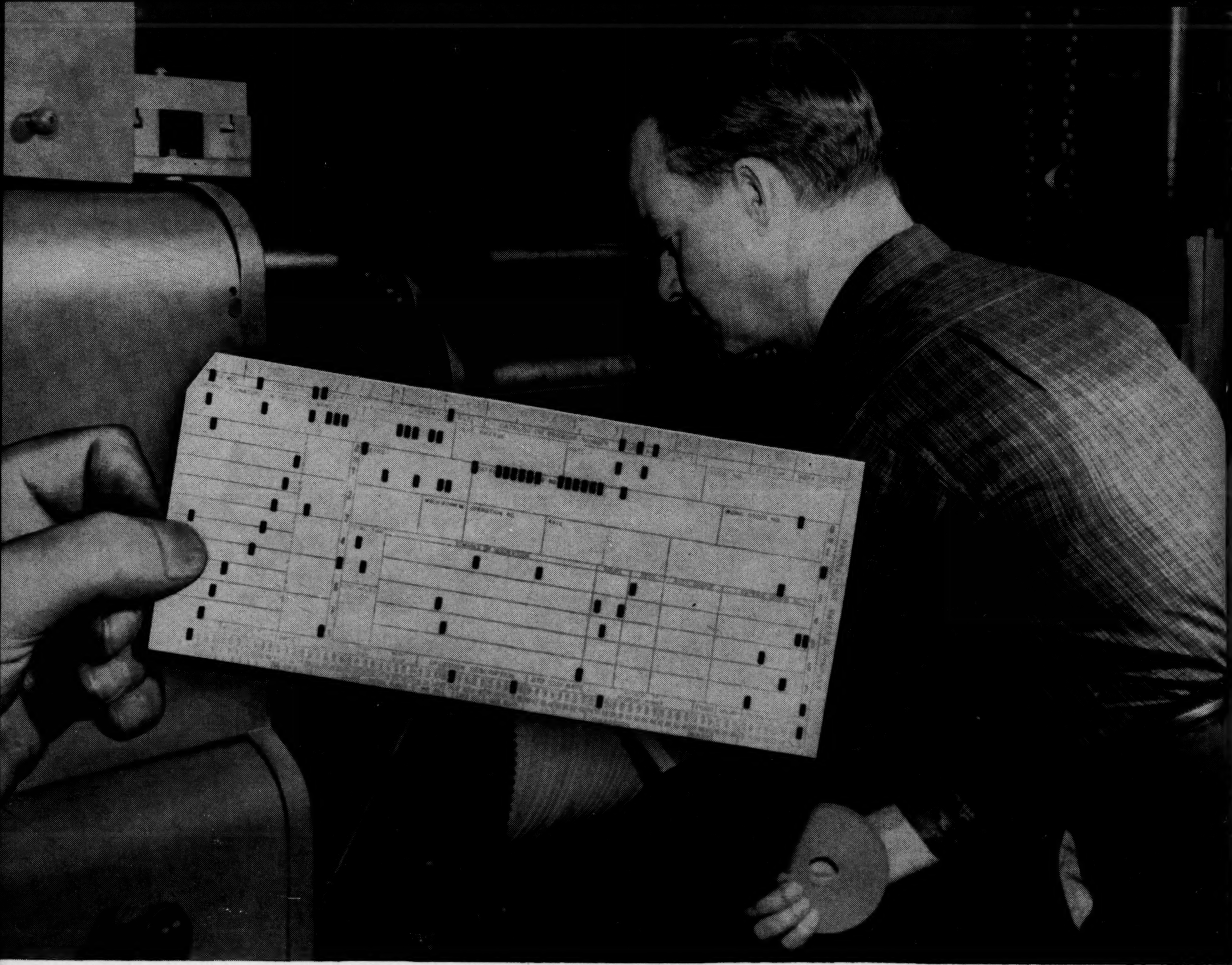
Priority Reversed

Now in an area that is obviously of vital importance to the survival of this nation and its allies we have reversed this priority and substituted the vague and less urgent demands of pure scientific research for the vital urgency required for development of new military weapons. While it has been proved by the experience in aeronautics and nuclear physics that civil requirements can be accommodated within the framework of a military-oriented research and development program, it is already painfully evident that the reverse is not true. A space research program oriented solely toward exploratory scientific research and civil operational uses will produce neither the knowledge nor the hardware required for military space systems.

The councils of government now are engaged in organizing the technical and management pattern of the most complex and significant technical development program ever undertaken in this country—the lunar landing program. Even at its most conservative cost estimating, it will cost 20 times more than the Manhattan Project and its increase in technical complexity defies comparison with any previous effort in our history.

If the military role in this program is defined as merely using its already substantial facilities and capability in space technology to support a program limited to civil scientific goals, we shall indeed face serious trouble as the challenge of Soviet military space becomes more apparent and Russian capabilities approach the operational phase.

—Robert Hotz



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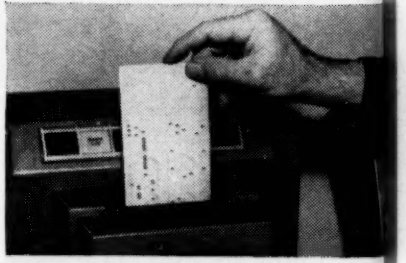

Fifteen IBM 357 Input stations and two central output control units handle all reporting and recording of employees' production at Line Material Industries.

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WHO'S WHERE

In the Front Office

Maj. Gen. William W. Quinn, Army chief of information, has been named deputy director of the new Joint Defense Intelligence Agency and **Rear Adm. Samuel D. Frankel,** deputy director of Naval Intelligence, has been named chief of staff of the agency.

Thomas B. Eastland, Jr., president, U.S. Infrared Corp., Washington, D. C. Other officers are: **Louis S. Amann,** chairman of the executive and finance committees; **Philip Luckhardt,** executive vice president; **Cecil Yates,** treasurer; **Louis E. Shomette,** general counsel.

Miniature Precision Bearings, Inc., Keene, N. H., has elected the following vice presidents: **Donald D. Davis; Robert E. Gengenbach; A. van Breems.**

Fred L. Martinson, vice president of the newly formed Engineering and Manufacturing Division of Electronic Associates, Inc., Long Branch, N. J., and **Richard C. Higbee,** vice president of the Division's Research and Synthesis Department.

Julius Martinez, vice president-sales and contracts, Maxson Electronics Corp., New York, N. Y.

Clifford E. Willis, vice president-operations, Avien, Inc., Woodside, N.Y.

Sam Wilson, executive vice president, South Pacific Air Lines.

Rear Adm. A. B. Metsger (USN, ret.), formerly a vice president of The Marquardt Corp., has organized Technology Services, Inc., Arlington, Va., to provide management and engineering consultation and general research and planning services.

E. Paul Burke, assistant vice president and regional general transportation manager, Atlantic Region, Trans World Airlines, Inc.

Dr. K. O. William Sandberg, assistant to the vice president and manager, Aerospace-Rockets Division of Textron's Bell Aerosystems Co., Buffalo, N. Y.

Lt. Col. Martin L. Raines, chief, U. S. Army Rocket and Guided Missile Agency's Pacific Field Office, Kwajalein Island.

Honors and Elections

Massachusetts Institute of Technology has announced that the **Aviation Week Fellowship** for 1961-62 has been awarded to **Reiner Decher,** studying for S.M. degree in Aeronautical Engineering in field of propulsion.

Gen. James H. Doolittle (USAF, ret.), board chairman of Space Technology Laboratories, has been named a charter senior member of the American Rocket Society, a newly established grade of membership in the Society. Other STL executives named charter senior members: **Dr. Ruben F. Mettler; Dr. George E. Mueller; Dr. William M. Duke; Dr. Adolph K. Thiel; Dr. George E. Solomon; Dr. Robert Bromberg; Dr. David B. Langmuir; Dr. R. D. DeLauer; Robert B. Rypinski; Carl W. Besserer; Dr. George C. Szego; John S. Piech; Dr. Donald P. LeGalley.**

A. D. Sharp, manager of equipment and engineering services at Goodyear Aircraft Corp., has been elected chairman of the Manufacturers Equipment Division, Aerospace Industries Assn., Washington, D. C.

INDUSTRY OBSERVER

▶ Apollo A three-man spacecraft for earth orbital missions will be tested in an orbit designed to keep it circling the earth for a period of two weeks to two months.

▶ **One proposal for an interim booster that could lift more payload than the Atlas-Centaur is an Atlas plus a Saturn S-4 stage powered by a 60,000-lb. Rocketdyne Atlas sustainer engine, modified to burn liquid hydrogen and liquid oxygen. Fuel for the Atlas sustainer now is kerosene. This proposal also would require strengthening of the Atlas airframe.**

▶ Air Force will not award its Nova contract until the Golovin committee (AW Sept. 4, p. 35) has completed its studies, probably in mid-October.

▶ **Long-range planning for the Atlantic Missile Range calls for accommodations for as many as 150 astronauts at one time. They would be trained at other bases but stationed at AMR for routine operational military and civilian space missions.**

▶ PERT management control system, developed for Navy's Polaris missile system, now has been applied by Air Force to the complete Titan II, Minuteman and Skybolt missile programs, and to the production phases of the Titan I and Atlas missiles and the B-70 and F-105 aircraft programs. It also will be used for the C-141 jet transport and TFX tactical fighter programs. Eventually, all major USAF system procurement will be controlled by PERT.

▶ **Orbiting solar observatory, originally scheduled to be launched by National Aeronautics and Space Administration in the next quarter with a Delta vehicle, has slipped several months because the University of Colorado has not found a small drive motor for the sun orientation system that dissipates heat rapidly enough.**

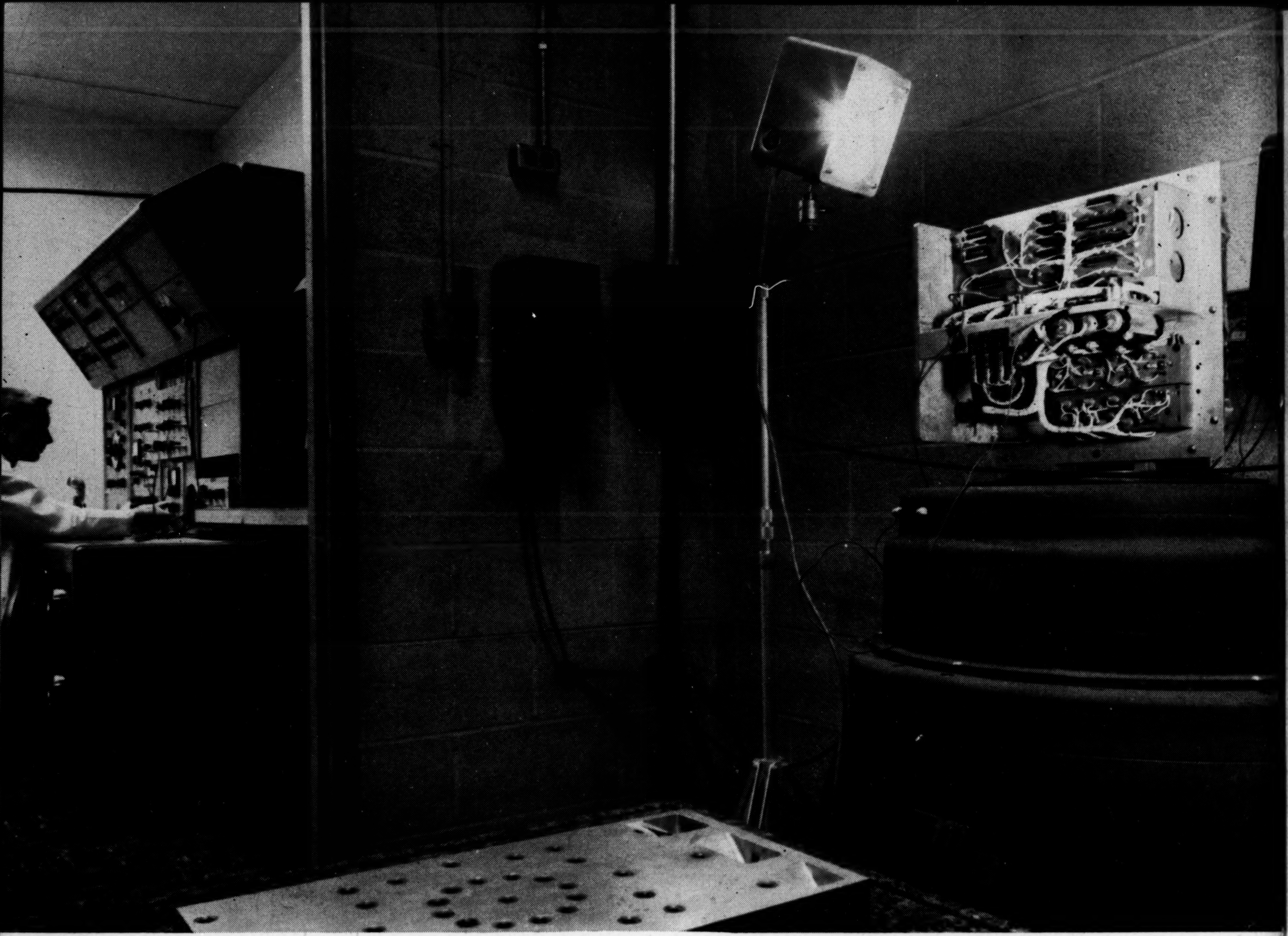
▶ Air Force has found through experience that 80 to 85% of vehicle cost for satellite space systems is in items other than payload. USAF and Lockheed found that the complexity required to achieve orbit control, re-entry of capsules, etc., makes the Agena stage—used in the Discoverer, Samos and Midas programs—more difficult to build than a Navy Polaris missile.

▶ **Life scientists at Northrop Corp.'s Norair Division implanted a frequency-modulated oscillator in a rib roast of beef to study what transmission characteristics might be from inside a human body. They hope to develop a telemetry system that would reveal internal responses to such external stresses as high g-loads. Information is needed for designing better body harnesses, supports and restraints.**

▶ Forces similar to the stabilizing characteristics of a mechanical gyroscope, which exist in molecules, atoms and nuclei, are being studied under Air Force sponsorship in an attempt to prove the feasibility of harnessing these forces for aircraft, missile and spacecraft guidance. Some success has been achieved in sensing how these forces operate.

▶ **Powered flight tests of the new Beech XKD2B-1 Mach 2 target drone at Pt. Mugu, Calif., indicate some instability around Mach 1.6 at 35,000 to 40,000 ft. Corrective measures, including increase in the wingtip stabilizing area, will be made prior to further tests up to the design speed and altitudes up to 70,000 ft. Indications are that the drone, which also carries the USAF designation Q-12, has a 27-min. usable target duration, including glide portion. Basic powered duration is 5 min. at Mach 2 or 8 min. at Mach 1.5. Development contracts cover 15 drones.**

▶ NASA's desire to test two stages of the Saturn C-1 vehicle as early as possible may lead it to divert early Pratt & Whitney LR-115 liquid hydrogen engines to the Saturn S-4 stage. This would further delay qualification of the Centaur stage, which uses the same engine.



SHAKING UP SATELLITES and space electronics is an important part of developments at Bendix Systems Division because, although life in space will be quiet, launch accelerations can exceed 25g. Electronic assemblies are developed based on tests with this 1200-lb. force exciter and in a 4′ x 8′ thermal vacuum chamber. Complete spacecraft will be shaken with a 30,000-lb. force unit, and then subjected to orbital simulation in our new 20′ x 27′ chamber. These expanding Space Laboratories are creating new career opportunities for senior personnel experienced in satellite and space system testing.

Qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

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Washington Roundup

One Voice on Space

Air Force Chief of Staff Curtis LeMay has ordered his service to hammer out a unified position on space. He has assigned a major general and a committee of 50 senior colonels to the job.

Shortly after Sputnik I was launched almost four years ago, Air Force began to lose space-oriented projects to the Advanced Research Projects Agency and the National Aeronautics and Space Administration. It has never pulled itself back together to the point where it could speak with a single voice on the importance of space to itself and to national survival.

Internal and external criticism now are forcing Gen. LeMay's hand. Observers say he is more favorable toward space efforts now than he was a year ago. But there are varying degrees of support in his office, in the air staff and in two other key elements of USAF—Systems Command, which develops and procures weapons, and Strategic Air Command, which deploys and operates them.

Last year, Gen. Bernard Schriever, Systems Command chief, ordered a review by the Air Force Space Study Committee, headed by former USAF assistant secretary Trevor Gardner. This was to be a blueprint for space efforts but its political overtones prevented that. A program of seven development plans was distilled from this report but that got bogged down in channels.

The "Green Hornet" plan was also prepared by Systems Command. It, too, met objections higher up. When some congressmen got a look at it they demanded that USAF pull its factions together. Now Systems Command has a group, headed by its Deputy Chief of Staff for Plans, Maj. Gen. J. F. Whisenand, preparing a new position.

Maj. Gen. William B. Keese, director of development planning in the headquarters office of deputy chief of staff for research and technology, is heading the committee of colonels. Top generals from each USAF command are being briefed and are getting a chance to give their views.

Next week the committee is to brief Gen. LeMay, and later it will brief Defense Department echelons. The result undoubtedly will be a compromise position, but Gen. LeMay has made it clear that it will be the one and the only official Air Force position on space.

Presidential Command

Plans for a national command and control system, designed to provide the President with a system that would survive nuclear attack and give instantaneous command over vital military forces will be prepared by a new Defense Department ad hoc committee. Headed by Maj. Gen. L. G. McCallom, it will attempt to resolve differences between the systems proposed by the individual services, the Joint Chiefs of Staff and the Director of Defense Research and Engineering. It also will recommend which agency should operate the system.

One corner of the complex space booster picture will be examined Sept. 26 when the Senate Aeronautical and Space Sciences Committee holds hearings on the significance, status, recent history and problems of the Saturn and Centaur launch vehicles. Saturn's configurations and powerplants have changed continuously and are still changing, and Centaur has slipped its schedule badly. Chairman Robert Kerr also has tentatively set a hearing on meteorological systems for October and one on space communications—at least as complex a problem as boosters—for November.

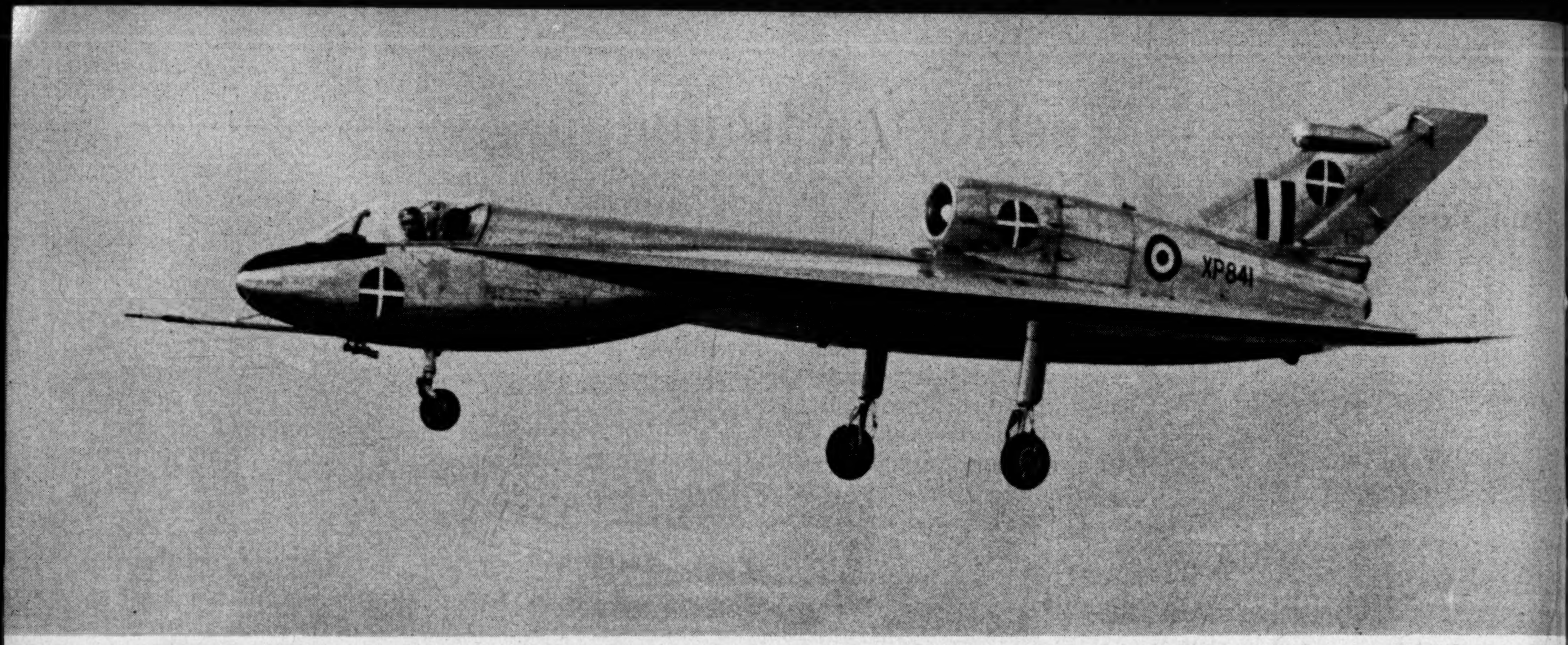
Watch for fast action from Labor Department to improve administration of the Davis-Bacon Act, which authorizes setting of minimum wages for construction jobs based on wages prevailing in the area. A study committee appointed last April has completed its report, which sets guidelines and urges better liaison between Defense and Labor departments and military contracting officers. Lack of a clear policy until now has touched off jurisdictional strikes by unions, infuriated contractors and confused contracting officers, especially at missile bases.

Air Corridor Concern

Greatest concern over the air corridors to West Berlin is the ease with which the Communists could jam navigation aids. Only the newest combat aircraft have the latest jam-proof radar that would be needed. Civilian pilots have formed a committee to look into the problem, but complain that they get little help because such matters are classified.

Compromise that ended six months of wrangling over the tactical fighter (see p. 30) was dictated by Defense Secretary Robert McNamara, but still was satisfactory enough to Navy and Air Force chiefs that they did not protest. Chief architect of the solution was Dr. Marvin Stern, deputy director of research and engineering for weapon systems. Stern, who agreed to serve for one year, has agreed to extend his deadline temporarily but expects to leave the job before the end of the year.

—Washington Staff



NEWEST PLANE at the Farnborough flying display is the Handley Page 115 delta research plane built to study low speed landing regimes (AW Aug. 28, p. 34). Flights are being kept to under 10-min. duration at Farnborough.

British Aviation Nears Crucial Decision

Industry must soon decide whether or not to join with Europeans in aircraft and engine development.

By Herbert J. Coleman

Farnborough—British aviation industry is facing a top-level management decision that will determine whether its influence on international markets will wane or increase.

The move, now in gestation form, will be whether or not to expand the industry outside the United Kingdom, primarily in Europe, and thereby join with European manufacturers in design and production of new aircraft and engines beyond license agreements that are, in any event, a start in this direction.

This is the dominant impression at the 22nd annual flying display of the Society of British Aircraft Constructors, the traditional British showcase for its products. As one member of the SBAC put it:

"Frankly, our industry is on its knees. We've got to move into cooperative manufacturing and sales agreements in Europe, and soon, or face the prospect of becoming components suppliers."

Research Narrowed

Perhaps a bit pessimistic, there is still support for this view. British aircraft manufacturers, now fairly successfully grouped, have eliminated parallel research—and the resultant competitive drive that leads to waste in invariable duplication—but consequently also have reduced effort into new fields.

Farnborough show, sprawled over a hillside near the Royal Aircraft Establishment, is an unwitting example since there is little new to show the industry, British public, and more than 8,000 visitors from overseas, including top Russian designers (see p. 26).

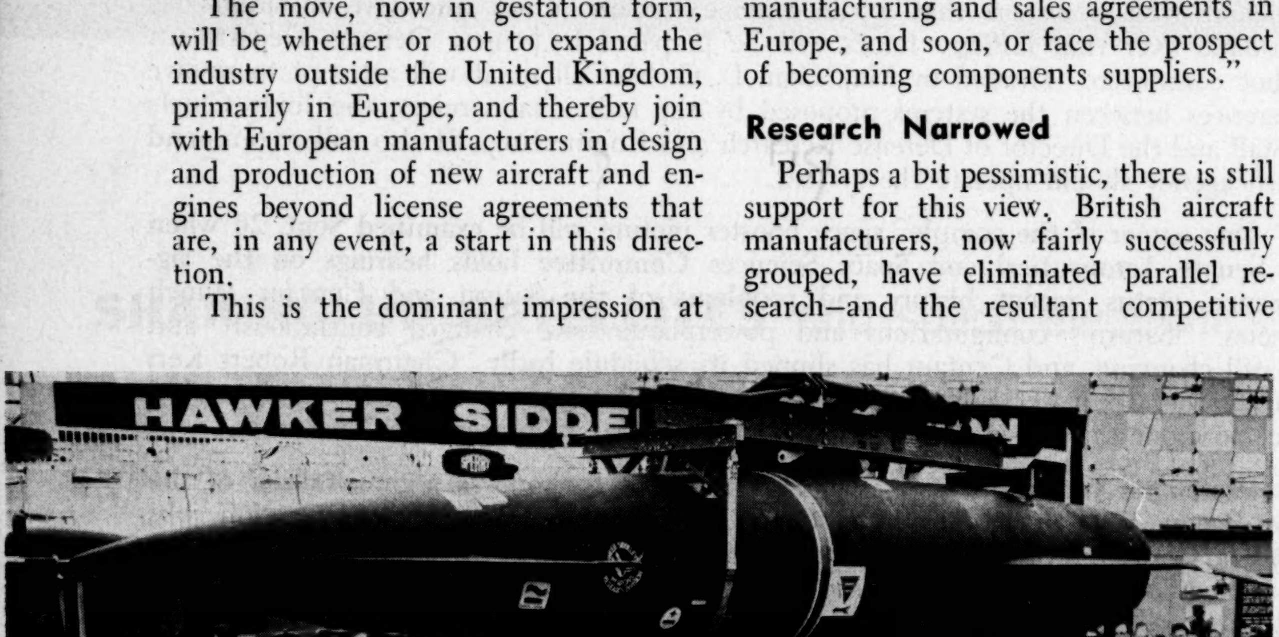
Most heartening aspect is the British world-wide lead in development and sale of its VTOL engine line, with Rolls-Royce and Bristol Siddeley products dominant in strike fighter competitions (see story p. 27).

As expected (AW Sept. 4, p. 78), the most interesting aeronautical developments were kept under wraps—primarily the Hawker P. 1127 NATO VTOL entry, the British Aircraft Corp.'s TSR-2 strike fighter, and the Bristol T.188 Mach 2 research plane.

Thus, the three services—Royal Air Force, Royal Navy and the Army—took over most of the flying display. Only new airplanes were the Handley Page 115, a highly swept delta which will be used to investigate landings at low speeds, and the Beagle 206, a five- to seven-place executive twin.

But not far from the runway was the symbol of Britain's fight to break out of its borders—the de Havilland Blue Streak, booster for the proposed West European space consortium, now moving closer to fruition following earmarking of space funds by the West German government.

The space club, and the high possibility of close cooperation with European manufacturers, can be laid in large part to the efforts of Minister of Aviation Peter Thorneycroft, the prime mover in breaking British reticence and nationalistic feelings against European ventures, and the best salesman



AVRO BLUE STEEL standoff bomb and ground handling truck and dolly for mounting the weapon in RAF's Victor and Vulcan B.2 bombers were displayed at Farnborough.

for the Bristol/Ferranti Bloodhound II missile sold to the Swedish and Swiss governments.

Thorneycroft said last week that West Germans have formally committed themselves to construction of a third stage for Blue Streak launchers, probably a Bölkow design. Second stage will be a French Veronique.

It was also Thorneycroft who backed more intensive government participation and support for the industry and its projects in an atmosphere ranging from lukewarm acceptance of the inevitable, to downright icy resistance from the British treasury, the indomitable and final factor in a project's life or death.

There also is an end in sight to the traditional British reserve in the sphere of aggressive salesmanship. An important indication was formation last week of a joint organization by British Aircraft Corp. and Minneapolis-Honeywell to develop, manufacture and market inertial guidance systems for aircraft and missiles in Europe (see box).

Britain's reliance on Blue Streak for the space consortium is important but secondary to the real role. That is in a comparatively new area of 11 nation cooperation, as against negotiation, leading one British space expert to muse: "I wonder how we will get anything up but uncased hot air, with 11 people, all speaking different languages, sitting around one table. We may launch the Tower of Babel." But he conceded the importance—unthinkable even two years ago—of the 11 European delegates planning serious projects in the same room.

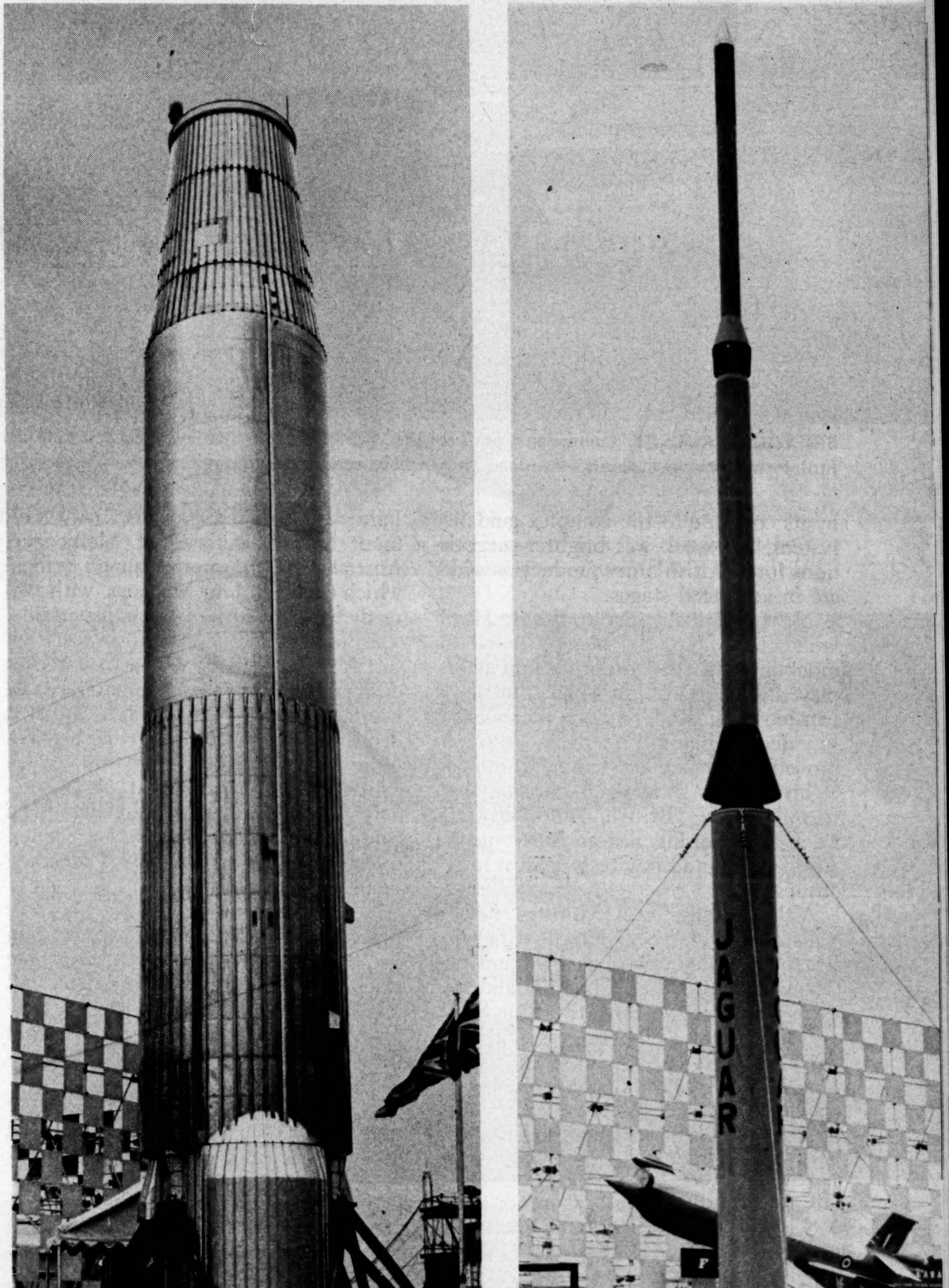
The missile park in a way reflects the flying display's emphasis on past achievements. Blue Streak towers over an Avro Blue Steel standoff bomb and is bordered by a Bloodhound I group and the Vickers Vigilant mounted on a Ferret scout car. Vigilant's future, hurt

BAC-Honeywell Pact

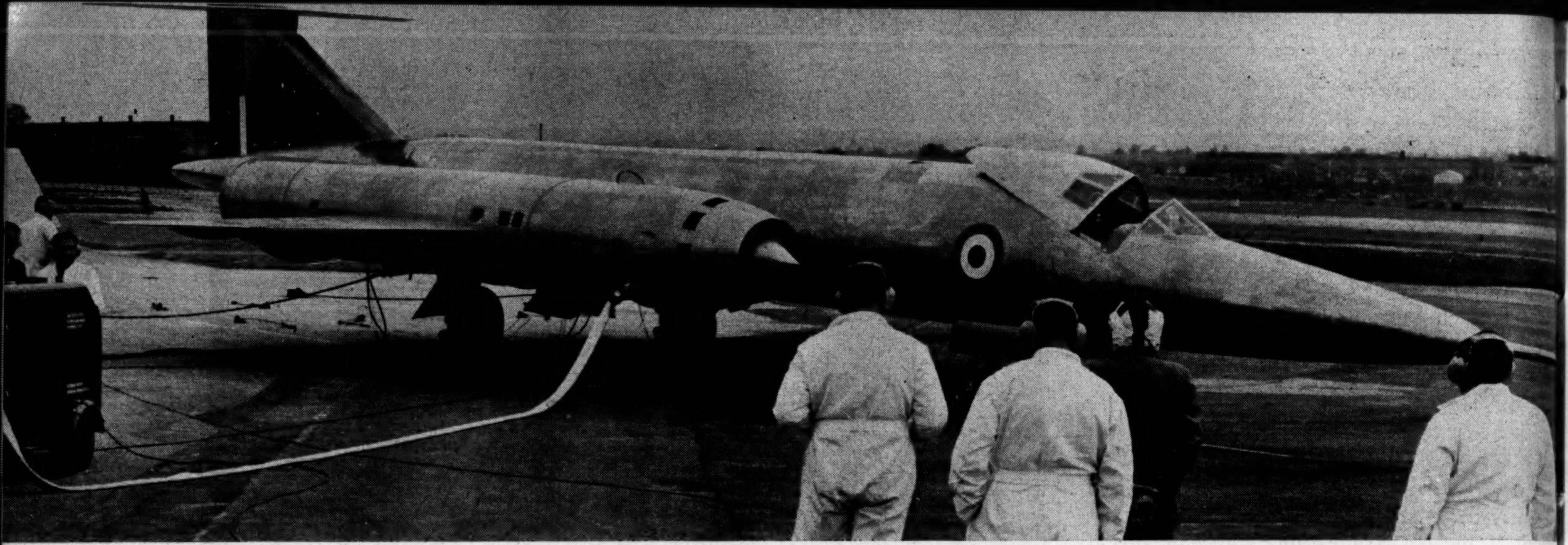
New York—British Aircraft Corp. and Minneapolis-Honeywell Regulator Co. have formed an organization named BAC-Honeywell Inertial Guidance-Europe to develop, produce and market inertial guidance systems for missiles and aircraft in Europe.

The new organization will be composed of personnel from both companies and will have its main offices in Paris.

Manufacturing will be conducted at British Aircraft Corp.'s plant at Stevenage, England, and Minneapolis-Honeywell's plants in Frankfurt, Germany, and London, England. Under their agreement the companies will share responsibility for design, development, production, field service and marketing of inertial guidance systems, inertial reference systems and related avionics.



DE HAVILLAND BLUE STREAK dominates missile display (left); powerplants are paired Rolls-Royce RZ.12s. Missile was raised to display position by highway crane, since ground handling equipment has not yet been developed. Jaguar (right) is three-stage test rocket, using solid fuels in all three stages. First stage boosts vehicle to 80,000 ft. At near horizontal flight, second stage is fired by radio control from ground and third stage fires automatically after second stage burnout.



BRISTOL AIRCRAFT technicians prepare the Bristol T.188 stainless steel research plane for ground testing of its de Havilland Gyron Junior turbine powerplants. Airplane will explore supersonic research, primarily in high heating regimes.

by its cost due to the complex guidance system, last week was brighter—negotiations for a British army production order are in advanced stages.

Newest British missile, the de Havilland Red Top, is being shown in mockup form (the same mockup as displayed at the Paris Air Show, but newly painted red). Red Top is a follow-on to the de Havilland Firestreak, with improved guidance system. Armstrong Whitworth is showing its Seaslug ship-to-air missile; British Admiralty last week said Seaslug has an 80% success ratio in high and low tests against target drones.

Although the Air Ministry flew a Vulcan B.2 testbed, fitted with two Bristol Siddeley Olympus 301s and two Olympus 201s, the V-bomber did not carry its prime weapon, the Blue Steel, or the Skybolt, now undergoing compatibility tests (AW Sept. 4, p. 55). A Vulcan model carrying Skybolt was on display by Hawker Siddeley.

Newest development in the Malkara anti-tank weapon system, developed by Fairey Engineering and built by government aircraft factories at Melbourne, Australia, is an armored launch vehicle which can carry four Malkaras, with two ready to fire. Carrier is air-transportable.

Important factor in British space effort is the Jaguar three stage test rocket designed by Weapons Research Establishment and the RAE. Solid-fuel rocket, displayed by the RAE, attains a maximum speed of 6,600 mph. for investigation of aerodynamics at about 80,000 ft. altitude. Also displayed is a gold-plated model of the British Scout I research satellite which will be launched in the U. S.

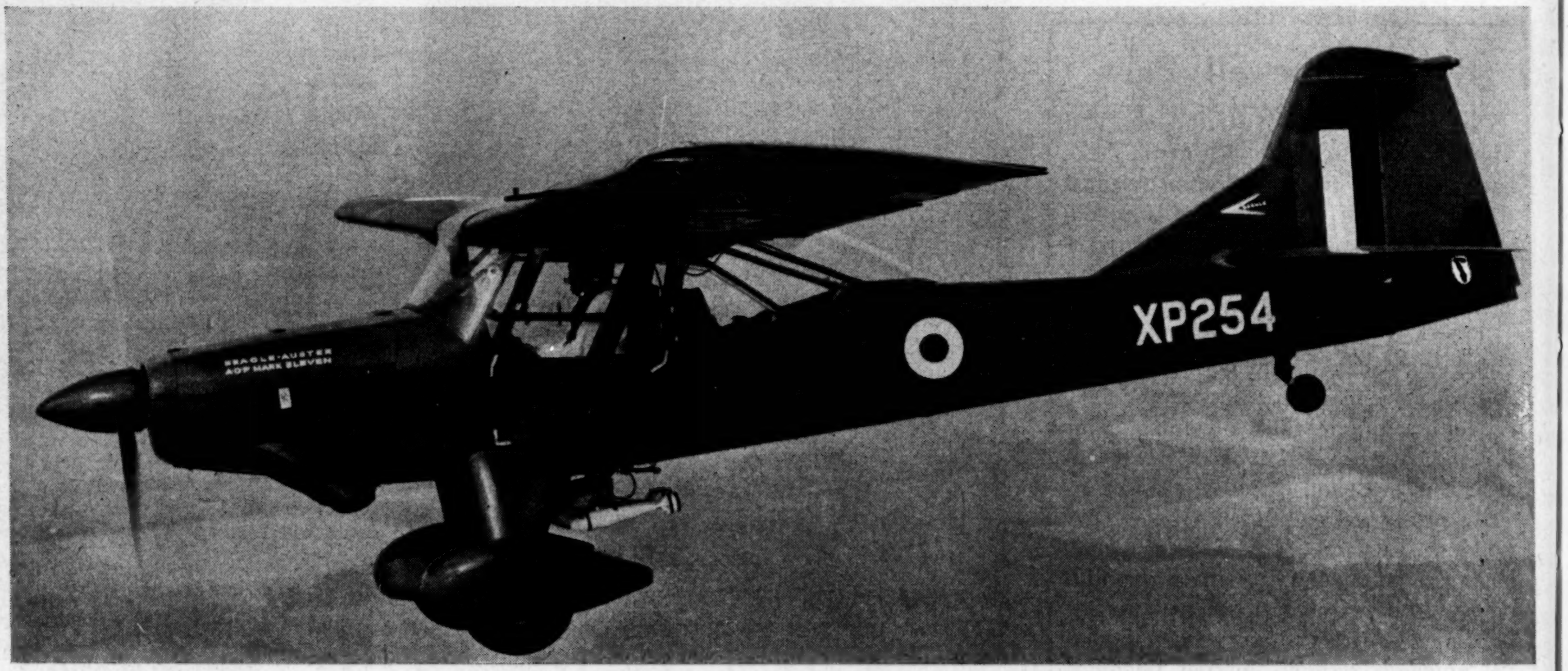
Only other missiles shown were the Blue Water surface-to-surface weapon for British army, shown in front-line placement with crews in readiness, and the British Army Thunderbird surface-to-air weapon, displayed by crews from the No. 37 Guided Weapons Regiment, Royal Artillery.

Lone British entry in the target drone field, the Jindivik 2B, powered by a Bristol Siddeley Viper 8, also was displayed by Fairey and the Australian government.

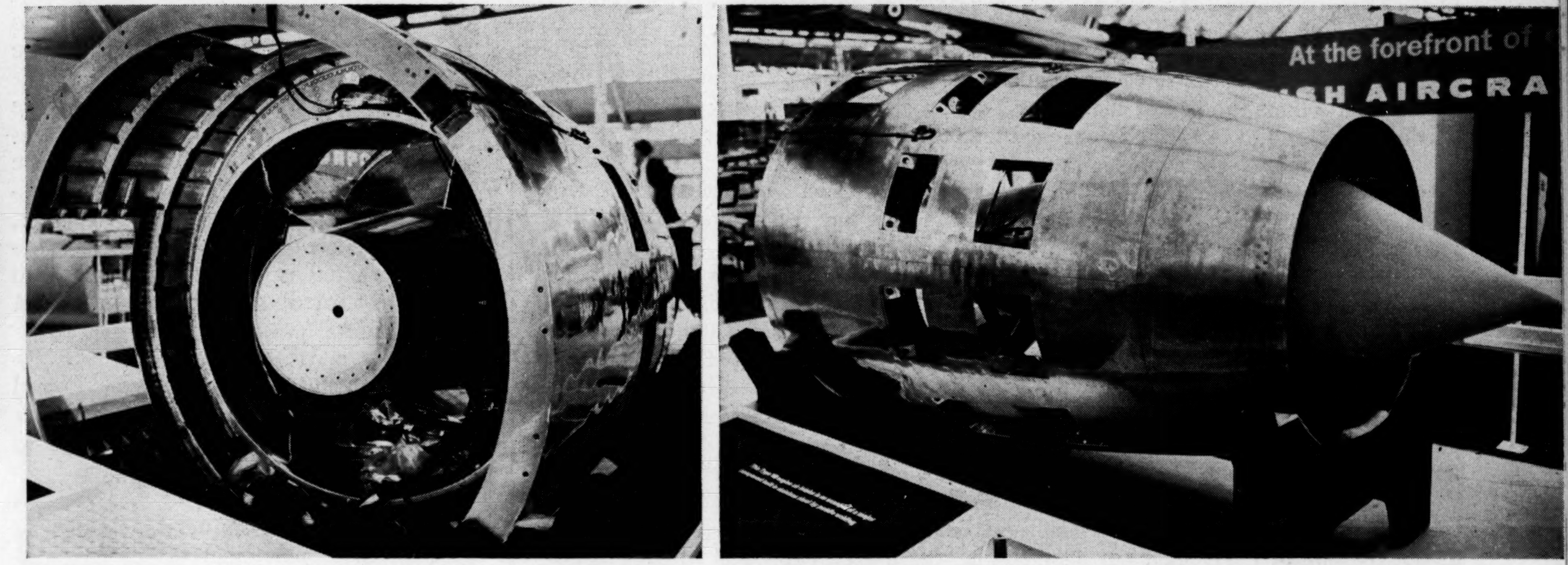
Manufacturers had little to say, and less to show, about the three new British military and test aircraft which have not yet flown—the TSR.2, the T.188 and the Handley Page H-126 jet flap research plane. TSR.2 has been kept in top secret classification, although it has been pitched to U. S. Department of Defense and the Australian government (as a replacement to RAAF's Dassault Mirage III fighters recently ordered, to the chagrin of British manufacturers, who could offer only the English Electric Lightning).

Newest civil and military planes, shown in either model or mockup form, are:

- **Short Skyvan II** light transport powered by two Turbomeca Astazou turboprop engines and scheduled to fly next year. Funded by Short Brothers & Harland (which is primarily government-owned) the Skyvan is aimed at the British army but H. G. Conway, Short's chief engineer and director, ad-



BEAGLE-AUSTER AOP Mk. 11 observation aircraft for British Army is powered by a Rolls-Royce 260-hp. Continental IO470. This follow-on to the Auster Mk. 9 has been cleaned up with landing gear fairings and smoother frontal area.



ENGINE AIR INTAKE section for Bristol's T.188 Mach 2 research plane was displayed as an example of a major component built in stainless steel by puddle welding (AW June 12, p. 93). Section houses 10,000-lb.-thrust de Havilland Gyron Junior DGJ 10 turbojet.

mitted the project had been slowed down to concentrate on the Belfast freighter ordered by the Royal Air Force.

Skyvan I powered by two Rolls-Royce Continentals, is in advanced construction stage and should fly early next year.

- **Beagle-Miles M-218,** four seater executive, and its single-engine version, the Beagle-Miles M-117 (AW Aug. 28, p. 32), both due to fly by next summer.
- **De Havilland DH-125** twin-jet executive plane, due to fly late next year with two Bristol Siddeley Viper 20s as powerplants. Production schedule calls for 30 planes, but the company submitted a proposal on the jet to the RAF as a navigation trainer and personnel transport, on the basis of a 50-plane batch. De Havilland last week placed a $3-million order for Viper 20s, and a new and improved version of the Viper 11, for its DH-125 line. Order probably is for about 60 engines.
- **Handley Page HPR.8,** a Dart Herald follow-on car-ferry designed primarily to Silver City Airways' specifications of capability for six cars and 30 passengers. Most unique feature is curved observation lounge which takes up the entire nose section. No orders have been placed.
- **Military version** of the Dart Herald with STOL capability and flap doors for rear-loading. Powerplants would be Rolls-Royce R.Da. Dart 10s, replacing the Dart 7s now in use.
- **Handley Page 117,** a 300-seat flying wing for transatlantic passenger services at 550 mph., and a Mach 2 delta wing transport featuring laminar flow for boundary layer control.
- **Westland 194,** a civil version of the Belvedere powered by four de Havilland Gnome turbine engines turning six-blade rotors. Project is a design study retained as a backup in case the Westland Rotodyne is not produced, and ro-

G-ARNP
G-ARNP

BEAGLE AIREDALE (above) is one of four planes shown by the new British executive plane manufacturer. Beagle 206 (below), newest British executive plane, was still fitted with test equipment when shown at Farnborough. Plane can carry five passengers if toilet is installed, or seven without.

G-ARRM
G-ARRM

Ilyushin, Antonov View Aircraft Future

Farnborough—Russian designers Sergei M. Ilyushin and O. K. Antonov, in a statement that runs counter to aging pronouncements by Soviet Premier Nikita Khrushchev but follows the line of the recent Tushino air show (AW July 17, p. 26), say they see no end to the need for manned military aircraft in the "near future."

Visiting the Farnborough air show as guests of the Society of British Aircraft Constructors, Ilyushin and Antonov hedged their statement by pointing out that they are engaged solely in the design of civil aircraft but said military planes "will exist in the near future."

Premier Khrushchev said in 1957 that Russia was turning solely to rockets for offense and defense and, until Tushino, many in the West believed him.

At Farnborough, speaking through an interpreter, Ilyushin and Antonov identified the E-66, which has claimed world speed and altitude records of 1,335 mph. and 112,294 ft., as a Mikoyan design, supporting the belief in the West that the designation supplied to the Federation Aeronautique Internationale was actually for the new Mikoyan delta interceptor shown at Tushino.

Ilyushin laughed off queries on reports that his test-pilot son made the space orbit officially attributed to Maj. Yuri Gagarin but was denied public acclaim because of a psychological or physical injury which the Russians did not want to admit. He said:

"My son was a very good test pilot, but he was in a car crash near Moscow which injured his ribs and legs and was not connected at all with the space flight."

Any report to the contrary, he said to reporters, "was just the imagination of one of your colleagues, I suspect."

Ilyushin and Antonov were accompanied by Sergei N. Leschenko, deputy chairman of the state committee of the Soviet aircraft industry.

torhead probably would be provided by Sikorsky if the helicopter is ever seriously considered. The Rotodyne, fast becoming a durable fixture at the SBAC show, made two flypasts which primarily demonstrated advances in suppression of tip jet noise. Prototype is flying with vaned suppressors to break up mass flow, but a model of Rotodyne-Z, the 75-passenger version powered by two Rolls-Royce Tynes, shows the bullet-type suppressor now being developed by Westland and the RAE. However, Rotodyne flew to Farnborough from Yeovil and did not make a takeoff or landing here, thus failing to demonstrate noise levels at these critical operating extremes.

- **Model of a stretched version** of the Vertol 107 powered by two advanced Napier Gazelles of 2,000 shp. aft-mounted on either side of the fuselage was displayed by Napier. Aft fuselage engine installation permits a straight fuselage design, provides easy accessibility and would provide room for an additional eight passengers. Version is still in the design stage.

In the flying display, new planes flown were limited to the HP.115 and the Beagle 206. Beagle was limited to eight minutes of flypast for its line of four planes, and thus the Beagle 206, first British executive plane to come on the scene since the Gemini, was held to two straightforward runs past the crowds. Beagle's new one-man helicopter, the Beagle-Wallis, was forced out of the show because it is powered by a U. S.-built McCulloch engine. Rolls Continentals for the Beagle line were assembled at Derby, thus qualifying the airplanes for entry under SBAC policy of keeping the show all-British. Newest British cargo plane, the Carvair, was not submitted for entry because it is a DC-4 conversion.

The HP.115 flypast was held to two flybys at comparatively slow speeds and with flight time limited to about seven or eight minutes.

On opening day, last Monday, the remarkable feat in the flying display was the fact that any airplanes took off. Ceiling was 300 ft. and visibility about 4,000 yards, but as many airplanes as possible flew, leading to what is probably the first flyby in history to be conducted by GCA controllers.

Two Sea Vixen jets from the Royal Navy's 800 Squadron, based on the carrier Hermes off the Isle of Wight, successfully demonstrated Royal Navy buddy inflight refueling for the first time in public. The airplanes joined up atop the overcast and were controlled by GCA into a 200-ft. flypast with the second plane simulating refueling from a drogue and probe system.

First plane off in the flying display was a Comet 4C, in Middle East Airlines' markings, and its run was timed with that of an Armstrong Whitworth Argosy 660, the military version, of which the ninth airplane made its first flight last week. RAF has ordered 56, but the 660 was not on static display because the RAF did not want to lose test time on one airplane for a week.

Military aviation again took over the helicopter demonstration, with the exception of the Rotodyne flyby. In this, a P.531 Westland Scout landed on a flatbed truck, part of a three-vehicle train, which then was towed down the runway by a Westland Wessex. In the background was a Belvedere unloading troops. Eight Saunders-Roe Skeeters did a form of square dance, in two groups of four, which ended in a line abreast.

Paratroops were dropped from three Austers to show precision landing techniques, hitting within 40 ft. of a flare marker. Major army effort was a simulated assault on the Farnborough tower, using the Blackburn Beverley, as paratroops backed up the attack, and Twin Pioneers landed support equipment and evacuated casualties.

Navy's acrobatic team, nine Scimitars from 800 Squadron, was allowed nine minutes for low flypasts and formation rolls, when weather improved later in the week. All-Navy flypast included the Scimitars, 10 Sea Vixens and four Fairey Gannetts. Blackburn NA.39 also participated, making extremely low passes at high speed.

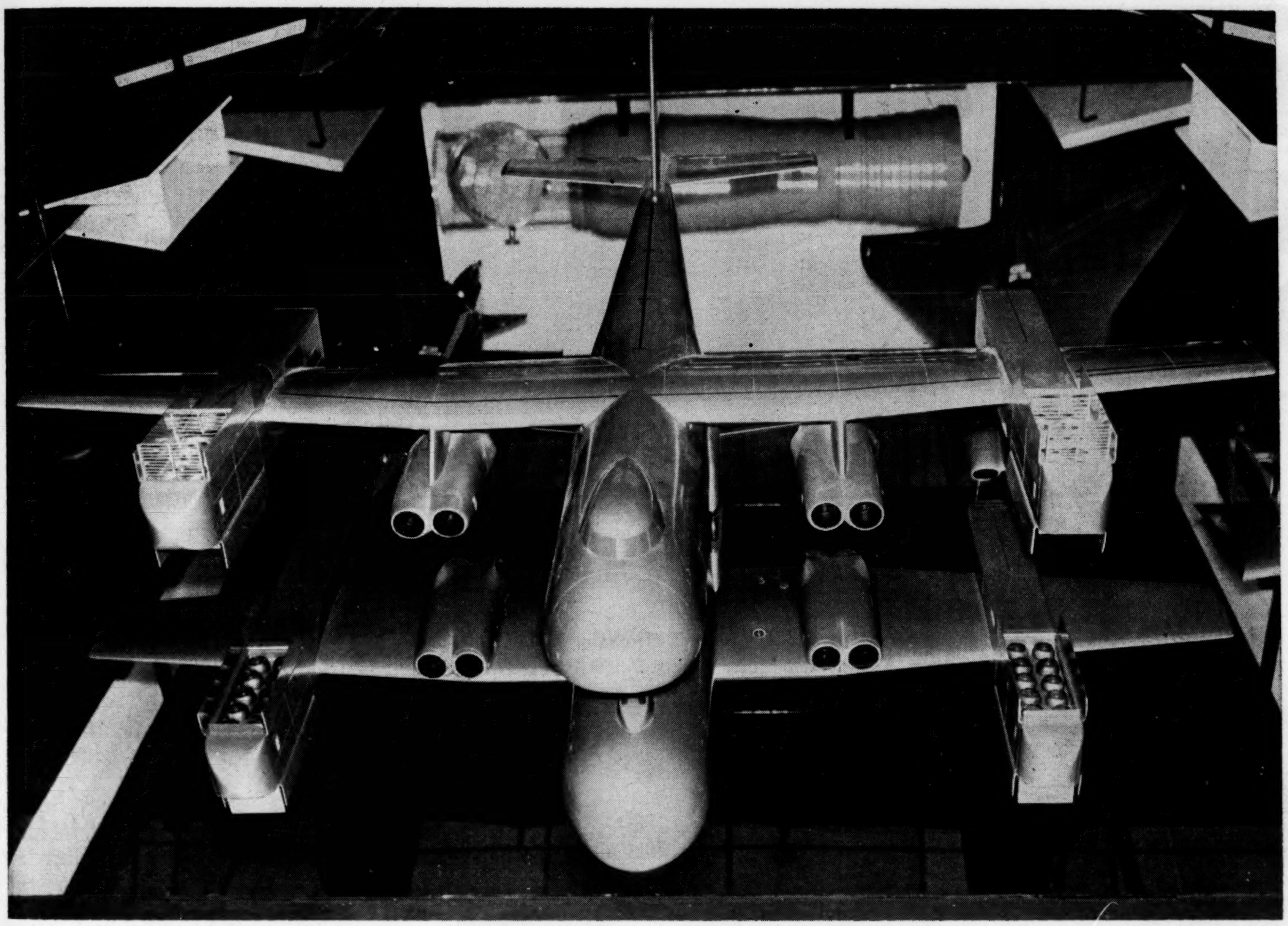
Royal Air Force entered three acrobatic teams—12 Hawker Hunters of No. 92 "Blue Diamonds" Squadron, nine Lightnings of No. 74 Squadron (AW July 3 cover) and four Jet Provosts of the Central Flying School.

While the Lightnings re-formed for maneuvers, a Lightning T.4 two-place trainer version, flew past at near sonic speeds, with shock waves clearly visible and blurring the upper wing section and cockpit. Initial work on a two-place interceptor, designated Mark 5 Lightning, is under way at English Electrics' Warton plant, and by Bristol Aircraft Co.; the plane has attracted some interest from foreign air forces as a possible British export.

The V-bomber participation was limited to a Vulcan B.2 takeoff and maximum performance climbout, and a scheduled high-altitude flypast primarily aimed at forming a complex pattern of contrails.

The Royal Air Force combined acrobatic team, only slightly hampered by occasional low ceilings, flew a series of formation rolls, trailing colored smoke. Lightning team showed a high degree of skill, despite its comparatively recent formation as the replacement to the famed Treble I Squadron which flew Hunters. Team excels at tight wingovers after low flypast and performed one nine-plane roll after re-forming from two groups.

Only transport entries, except the Argosy 660 and the Comet 4C, were a Dart Herald, in Maritime Central markings, and an Avro 748 in Skyways markings. Both did low flypasts, with the 748's second run showing port engine feathered, gear and half flap down, and making a gentle climbout in the dirty configuration. Showing of another SBAC standby, the Short SC.1 VTOL, expanded its usual display of liftoff and turns in a small radius, to the highspeed flypast.



PROJECTED ROLLS CONFIGURATION for a tactical V/STOL transport incorporates clusters of 32 turbine lift engines in each wing pod. Forward grills divert air flow into engine intakes. Model is resting on a mirror which reflects underside.

NATO V/STOL Proposals Take Shape

By Cecil Brownlow

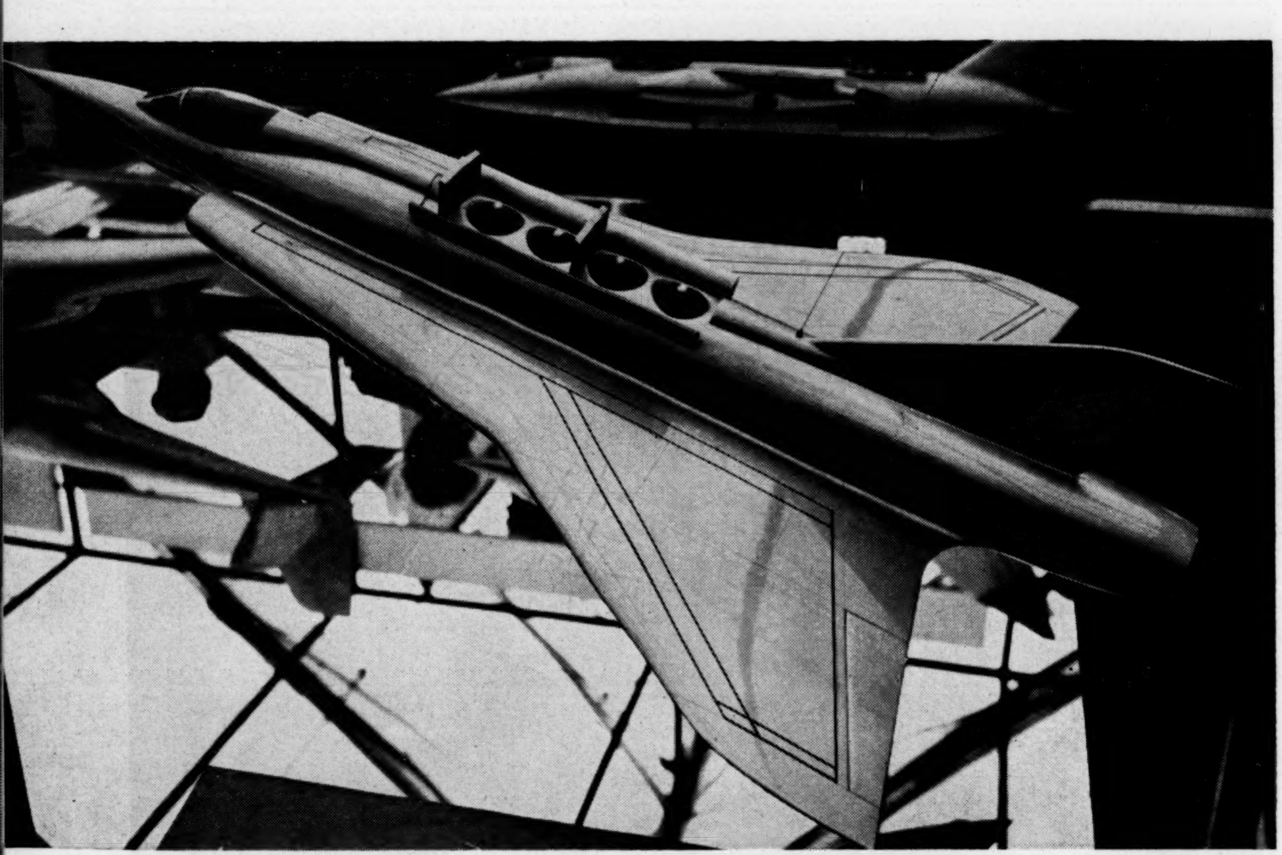
Farnborough—At least six design proposals will be entered in the North Atlantic Treaty Organization competition for a lightweight V/STOL close-support fighter, all of them built around British engines.

The competition, whose winners will share possibly the biggest plum for European industry over the next several years, is being waged overtly and covertly on political and technical levels with a series of agreements and counter agreements in both areas extending from Britain to the U. S. and onto the European continent.

At the 22nd exhibition of the Society of British Aircraft Constructors here, Rolls-Royce and Bristol Siddeley exhibited two distinct design approaches to the lift engine problem. Both companies have been contacted by U. S. engine firms concerning the possibility of licensed manufacture in the U. S.

Proposals for the NATO competition, which has a Dec. 31 deadline, include the following:

- **Follow-on version** of the transonic Hawker Siddeley P. 1127 tactical fighter powered by an advanced development of the Bristol Siddeley BS. 53 lift-thrust turbofan engine with a projected thrust of between 27,000 and 28,000 lb. The present BS. 53 powering the two 1127 prototypes now on hand has a maximum thrust of approximately 18,500 lb. An agreement to cooperate on the development and submission of the design proposal was being hammered out last week by representatives of Hawker Aircraft, Ltd., and Germany's Focke-Wulf in an important by-play to the Farnborough show.
- **Republic-Fokker** variable-sweep aircraft (AW June 5, p. 30) powered by the Bristol Siddeley BS. 100, an advanced BS. 53 design producing a maximum thrust of about 38,500 lb. Republic also had hoped to work with Hawker on the project, gaining the test data on the 1127, but apparently lost out when the Focke-Wulf offer was accepted. Fuselage of the Republic-Fokker design follows the general lines of the Republic F-105 with the incorporation of a high cranked delta wing.
- **German VJ-101,** built along the concepts of the Bell D-188, powered by a conventional jet powerplant for forward flight and Rolls-Royce RB. 162 turbojet lift engines for vertical takeoff and landing. Four RB. 162s are mounted in each wingtip pod which swivels downward from the horizontal for vertical flight. Aircraft development, with the first prototype flight scheduled for next year, is being conducted by a consortium composed of Messerschmitt, Heinkel and Bölkow.
- **Dassault-Sud Balzac** vertical takeoff fighter developed around the Mirage III airframe using four fuselage-mounted RB. 162s for vertical flight. The RB. 162s, with a thrust-to-weight ratio of 16 to 1 and a probable maximum thrust of about 6,000 lb. each, would be mounted in line along the center fuselage section of the aircraft. A development aircraft using a standard Mirage III airframe and powered by four 2,500-lb.-thrust RB. 108s, a predecessor of the RB. 162, is now being tested. Possible powerplant for horizontal flight is a version of the Rolls-Royce Conway bypass engine.
- **Nord Aviation** design incorporating a



CRANKED DELTA-WING model shows general layout for RB. 162 lift engine in Dassault-Sud Balzac V/STOL close-support fighter, a contender in the current NATO competition.

SWEPT-WING supersonic V/STOL model displayed by Rolls-Royce is powered by four Rolls RB.162 turbine lift engines for vertical flight, two mounted ahead of the central weapons bay and another two immediately behind it.

Bristol Siddeley engine, probably the BS. 100.

- **Fiat G.95**, a V/STOL version of the G.91, current NATO close-support fighter. Powered by five lift engines, probably Rolls-Royce engines, and two conventional Bristol Siddeley turbojets, the aircraft is still in the paper study stage.

The Hawker, Focke-Wulf agreement now under discussion follows a government-to-government pact signed last March by Britain and Germany for the joint development of a follow-on to the 1127. The Hawker design for such an aircraft already is in its advanced stages, and signing of the agreement depends largely upon just how many alterations or specifications the German firm may insist upon, a Hawker spokesman said last week.

The aircraft also probably will have a supersonic on-the-deck capability, although, for the moment, the Hawker spokesman said the firm is going slow on guaranteeing speeds since "we're dealing with new parameters and, with what NATO wants, there are bound to be things sticking out, and we really don't know what it will do."

Performance Stipulations

The NATO design specifications stipulate a minimum on-the-deck performance of Mach .92 but add that any increase above and beyond this will be welcomed. The all-weather Republic-Fokker proposal has a design on-the-deck capability of Mach 1.25.

Focke-Wulf also is working on a V/STOL tactical transport design using the RB. 162 in wingtip pods for vertical lift (AW June 5, p. 30). The aircraft is a probable contender in the NATO competition for a V/STOL transport to support the close-support fighter at its dispersed sites.

Another German firm is working with Bristol Siddeley on a tactical transport design with a BS. 100 slung in pods beneath each wing, and it is another possible NATO entry, which has a deadline of Nov. 15 for the submission of designs.

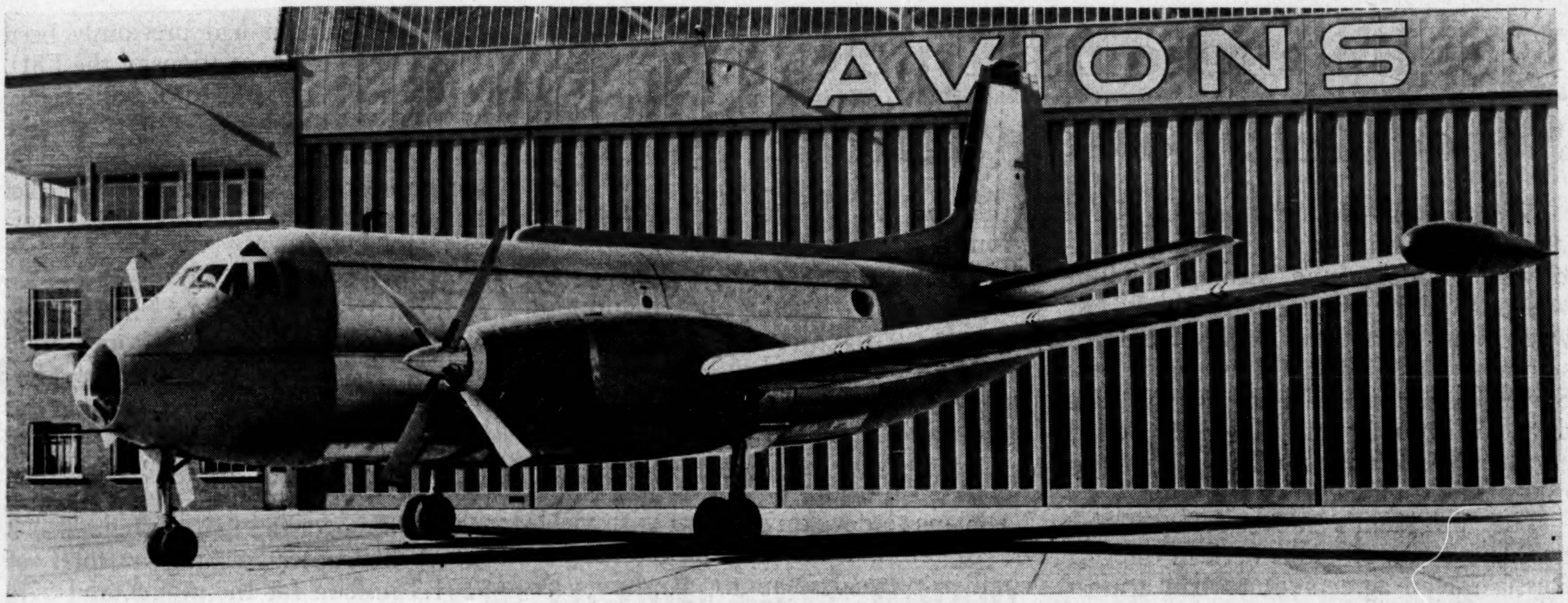
For both the close-support fighter and transport, NATO has said it will favor designs sponsored by a consortium of firms, and production orders for the airframes and engines probably will be spread among several countries.

Although basically wedded to the concept that "all the thrust in an aircraft must be available for both vertical and horizontal flight," Bristol Siddeley is turning to the development of high bypass ratio ducted fan engines with thrust-to-weight ratios of at least 14 to 1 for use aboard long-range commercial V/STOL transports which would make use of the BS. 100 as its major powerplants.

Fan-Powered Design

A possible design consideration shown in an artist's drawing at Farnborough has two podded BS. 100-type engines under each wing with ducted fans housed in pods at either wingtip. Fan engines are necessary for such an aircraft, Bristol says, in order to obtain the range needed for commercial applications since the fuel consumption of a BS. 100-type engine is relatively high when full thrust is applied for takeoff. On a commercial transport, where takeoff thrust would be several times greater than cruising speed, ducted fans similar to the competing Rolls-Royce designs would be used to augment the main engines during the vertical phases of takeoff and landing.

For military purposes, however, Bristol Siddeley engineers believe their "single engine" concept has several advantages in the areas of logistics support, simplicity and operation from the unprepared, dispersed sites envisioned by NATO.



Breguet Completes First 1150 Atlantic ASW Turboprop for NATO

First prototype of the Breguet 1150 Atlantic anti-submarine warfare aircraft rolls out of the Breguet factory in Toulouse, France. The airplane, powered by two Rolls-Royce Tyne powerplants, is being built under a NATO-sponsored program involving six European companies. Sud Aviation builds the outer wing sections, SABCA and Fairey jointly handle installation of the engines, Fokker supplies the center fuselage section and the engine nacelles and Dornier builds the rear fuselage section and tail. The Atlantic has a gross weight of 86,000 lb. a 124-ft. wing span, is 90 ft. long and carries a crew of 12. Cruising speed is estimated at 375 mph. First flight of the Atlantic is expected late this month or early October. Atlantics gradually are to replace Neptune ASW aircraft now in service with France, Belgium, Holland and Germany. Production of approximately 200 is expected.

A major drawback to the straight lift engine, one top Bristol engineer contends, is that, in most designs, it always is pointing downward, increasing the possibility of ingestion of debris thrown over the aircraft by the thrust of the vertical powerplants during pretakeoff checkout and the initial seconds of vertical flight. Such dangers are minimized on a BS. 53-type installation, he adds, since engine checkout can be conducted with the four swiveling nozzles in the horizontal position.

The company also believes that a STOL ground roll of approximately 500 ft. will be possible at most of the dispersed sites. In this case, the aircraft could begin a normal ground roll with its nozzles horizontal, then swivel them downward to 60 deg. for takeoff, with 87% of the thrust diverted to lift.

This takeoff procedure also avoids another major worry on the minds of VTOL designers—whether on an unprepared grass site, the thrust of the engines will simply dig the aircraft into the ground rather than getting it into the air. To avoid such a possibility and minimize the possibility of debris ingestion, the German VJ-101 concept envisions the use of a landing and takeoff platform at each site, a possible complicating logistics factor. The wingtip RB. 162s of the VJ-101 can be checked out, however, with the pods in their horizontal position, avoiding the dangers of a prolonged ground checkout with the thrust directed vertically.

In support of its design philosophies, Rolls-Royce says its research has included "practical tests of exhaust gas recirculation and ground erosion by jet lift engines. The results show that these are not likely to be serious problems."

So far as ground-support equipment is concerned, Bristol Siddeley says its engines will need little or no outside aid at a dispersed site since both the BS. 53 and BS. 100 have cartridge starter systems.

In the realm of speed, the company says BS. 100-type engines have a growth potential at least up to Mach 3.5. "The 1127," a Bristol Siddeley spokesman says, "was designed from the start as a transonic aircraft, but this led to our competitors saying that a big, fat engine couldn't be used for supersonic flight. Now, we've proved that this can be done."

In Farnborough literature, the 1127 is billed as "the world's first operational vertical takeoff tactical strike aircraft." Officials connected with the project privately concede, however, that, at present at least, it is still largely an experimental aircraft. Takeoff thrust is marginal in proportion to the weight of the aircraft, range is severely limited, and there have been a number of stability problems in flights thus far. Tethered hovering tests began in October, 1960, and conventional flight trials began last March.

Development of the BS. 53 and BS. 100 has been supported in part by U. S. Mutual Development funds, and the government in return has the license rights for U. S. production of either or both for military purposes.

The Rolls-Royce Farnborough exhibit included a model showing the approximate positioning of the RB. 162 in the Dassault-Sud Balzac, although it incorporated a cranked delta wing rather than the straight delta of the Mirage III; also shown was a possible follow-on with two lift turbines forward of the swept wings and another two aft plus Rolls deflector systems on the two chin-mounted conventional engines that could divert a portion of their thrust downward to aid in vertical lift, and a V/STOL tactical transport model with two wing pods, each housing 16 jet lift engines.

An alternative configuration of the latter also was shown, with each pod containing 20 lift fan engines which provide a considerable reduction in noise over the straight turbine.

Thrust of the jet lift engines in the transport design would be approximately 4,750 lb. each, with two wing-mounted Rolls-Royce Tyne turboprop powerplants supplying power for conventional flight. The fan engines would have thrust of about 6,500 lb. each, and the aircraft would incorporate two 15,000-lb.-thrust turbojets with jet deflection.

In support of its concept of separate engines for lift and thrust, which also cuts the weight requirements for the over-all engine installation, Rolls says: "The composite powerplant allows the aircraft designer a good deal of freedom in choosing a layout best suited to the particular flight mission. For example, a narrow delta configuration may be selected to reduce structure weight, since, with a VTOL aircraft, takeoff considerations no longer compromise the wing design. If the mission calls for supersonic speed, the minimum frontal area will be reduced. "There is no powered lift system which will be universal to all aircraft types. The optimum lift system will be dictated by the specific aircraft duty."

U.S. Underground Nuclear Tests Scheduled; Soviets Ignore Offer

Washington—Resumption of U.S. nuclear weapons tests "in the laboratory and underground with no fallout" was ordered by President Kennedy last week after the Atomic Energy Commission announced the third explosion of a Soviet device in central Asia in five days. Within 24 hr., Russia exploded another device with yield in the low to intermediate range.

The President's move followed by two days a new Anglo-American offer to Russia for an agreement to ban atmospheric nuclear testing. This has been ignored. Nuclear test ban talks, which were resumed in Geneva last spring, were terminated with the Soviet announcement that it would begin new tests (AW Sept. 4, p. 27).

Atomic Energy Commission Chairman John A. McCone said he believed that Russia has both political and scientific reasons for the tests. Of the first three shots, one was rather large and two were "quite small," he said.

If the Soviet objective had been only political, there probably would have been several large explosions, McCone said. He also said he felt that there was no need for the U.S. to "jump into atmospheric testing at this time."

Military sources, however, indicated that underground testing would be limited to smaller tactical weapons for air-to-air, air-to-ground, battlefield, artillery and anti-missile missiles. It also would be possible for the so-called "neutron bomb" to be tested underground if it were developed.

Military officers believe that Russia has the most to gain from resumption of tests. It has been unable to improve on its thermonuclear, or hydrogen bomb, since the moratorium was voluntarily placed in effect in 1958. The U.S. had fired that type with yields of up to 20 megatons. Russia has said it has plans to develop weapons with yields of 20, 30, 50 and 100 megatons. In smaller tactical weapons, Russia is believed to be far behind the U.S. unless it has conducted clandestine tests.

Since thermonuclear weapons are combinations of fission and fusion devices, present tests of intermediate size devices could be of components for the "super bombs." McCone believes that the current series of Soviet tests are a prelude to testing of bigger weapons.

Reaction to the tests among Western nations was uniformly condemnatory. Among the non-aligned nations meeting at Belgrade, Yugoslavia, there were strong expressions of disapproval.

A communique from the conference called for a prohibition of nuclear tests immediately by moratorium until a formal accord can be reached. They avoided a formal stand on the Berlin issue, calling for a settlement by negotiation.

Meanwhile, Communist interference with the air corridors leading to Berlin was expected in allied headquarters. This could take the form of Soviet withdrawal from the Air Traffic Safety Center in Berlin or of direct interference with flights.

Strength of U.S. Army reserve units alerted for possible duty in the Berlin crisis was increased by adding four National Guard divisions, 475 smaller Guard and Army reserve units and 52,000 individual reservists—a total of 148,000 individuals.

Saturn Assembly Site

Washington—Selection of a World War II plywood aircraft plant in Michoud, La., as the site for fabrication and assembly of Saturn C-1 and C-3 boosters was formally made last week by the National Aeronautics and Space Administration.

The plant, also used to assemble tank engines during the Korean War, is valued at $50 million. It consists of 846 acres and three buildings, one a 1.86-million-sq.-ft. assembly shed. Its use in Saturn construction was predicted by Aviation Week July 31 (p. 34), and was confirmed last week by Rep. Edward F. Hebert (D.-La.).

The plant will be operated by a contractor not yet selected and will be under the management of NASA's Marshall Space Flight Center. Bidders conference will be called soon for potential contractors, and will be held over a two-day period at Michoud and Huntsville, Ala. NASA expects the plant to be in operation within a year.

Navy Aircraft Buys Total $274 Million

Washington—Navy last week awarded contracts amounting to $274 million for additional orders of aircraft already in production.

McDonnell Aircraft Corp. will get $180.1 million for manufacture of F4H-1 Phantom II fighters, making a total of $548,996,623 allocated for the record-breaking, carrier-based aircraft.

An award of $58,038,000 for F8U-2NE Crusader night fighters was made to Ling-Temco-Vought Corp. A total of $361.6 million had previously been committed for all variations of the F8U.

Lockheed Aircraft Corp. will receive $13,319,328 for production of the P3V-1 Orion four-engine turboprop anti-submarine land-based aircraft. Total committed to the program is now $152,400,000.

A total of $2,100,709 will go for additional S2F-3 Tracker carrier-based, twin-engine ASW aircraft from Grumman Aircraft Engineering Corp. Previously, $98,242,557 was committed for the model.

Sikorsky Aircraft Division of United Aircraft Corp. received contracts for $7.3 million for the twin turbine HSS-2 ASW helicopter making a total of $101.3 million for the model, and $7.1 million for the HUS-1 assault transport helicopter for a total of $60 million.

Douglas Aircraft Co. was awarded $6,890,340 for production of A4D-2N Skyhawk carrier-based attack aircraft. A total of $303.5 million is now committed to the program.

Agreement Reached On Tactical Fighter

Washington—Air Force and Navy have announced agreement on general specifications for the TFX high performance tactical fighter intended for air superiority, reconnaissance, interdiction and general troop support.

Requests for bids are expected to be mailed in three weeks. The program will be managed by the Air Force Aeronautical Systems Division at Wright-Patterson AFB, with full Navy participation. A contract will be awarded in 1962.

The two services had been in disagreement over what the requirements of the aircraft should include (AW Aug. 21, p. 27). Air Force insisted on long ferry range and Mach 2.5 speed capabilities. Navy wanted the aircraft to be carrier compatible and with shorter range capabilities.

As the Defense Department-dictated compromise now stands, the aircraft has long ferry range but still will be able to operate from aircraft carriers. The Air Force has accepted features that will limit its original mission plans for the aircraft and the Navy has a larger vehicle than it wanted.

For future close-support roles the VAX fighter, being managed by the Navy for the Army and Marine Corps, will complete the needs for tactical purposes.

Defense Dept. originally had hoped to accomplish all these missions with a single aircraft.

In addition to individual competitors, a team composed of General Dynamics/Ft. Worth and Grumman has entered the TFX competition.

He has a hand in planning for the men in the moon

He's one of a staff of AMF engineers who are solving space environment problems on a here-and-now basis.

He has plans for an orbital launch facility (picture, top left) to help them get there in the first place. Inside, in a shirt-sleeve environment (top, right), a space vehicle can be prepared for launch to the moon itself. On the moon (center), connected structures above and below the surface are required for the Advanced Habitation Engineering needed to support a permanent lunar base. Lunar traverser (bottom) is used to move men and materials and assist in construction of a permanent base.

Already, AMF has designs and concepts which make those pictured obsolete. As new knowledge becomes available, AMF quickly incorporates it into simpler, more reliable, more easily fabricated mechanisms.

AMF has completed and is now carrying on studies and feasibility investigations covering a wide range of space environment problems in conjunction with space vehicle manufacturers and for several government departments. Space environment, itself, is just one of a virtually complete spectrum of AMF defense capabilities.

For more information, write American Machine & Foundry Company, Government Products Group, AMF Building, 261 Madison Avenue, New York 16, N. Y.

AMF

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Correction

Navy's Bureau of Weapons has recommended selection of Texas Instruments, Inc., to produce its ARM air-to-ground, anti-radar missile. Aviation Week incorrectly reported that the Bureau had recommended Ling-Temco-Vought (AW Aug. 28, p. 37). Navy's final decision is expected within two weeks.

Requests for proposals were sent to 17 firms, and 13 companies, including Texas Instruments, replied. Ling-Temco-Vought submitted an unsolicited proposal.

Space Range Expansion To Cost $885 Million

Washington—National Aeronautics and Space Administration expects to spend $885 million over the next four years to acquire and develop 80,000 acres adjacent to the 15,000-acre Air Force facility at Cape Canaveral, Fla.

NASA gave this cost estimate to the Senate Aeronautical and Space Science Committee in asking permission to spend $60 million to acquire the land. The Senate last week authorized the expenditure and the House is expected to follow suit.

The congressional authorization is needed in order to begin buying the land, but NASA will not ask for the appropriation until the next session of Congress since it has enough money on hand now to start the land acquisition program.

Dr. Hugh L. Dryden, deputy NASA administrator, said that in addition to the $60 million for the land, it is estimated that the six launch sites and supporting facilities will cost $700 million and instrumentation $125 million or a total of $885 million.

NASA hopes to finish the expansion project in about four years (AW Aug. 28, p. 30).

NASA Administrator James E. Webb told the committee "it is already obvious" that the agency will have to use boosters with 12 to 20 million lb. of thrust. He said existing facilities at Cape Canaveral cannot accommodate these big boosters and their supporting equipment, partly because the noise from them necessitates isolating them with a land strip of from 7 to 10 mi. wide.

Webb said NASA did not seek authority to acquire the land during its regular appearance before the committee earlier this year because at that time, there was a possibility that Defense Department could furnish the needed facilities.

The Army Corps of Engineers made the cost estimates for the land acquisition, Dryden said, figuring that average per acre cost would be about $750.

News Digest

Discoverer XXIX was successfully recovered after remaining in a polar orbit for over 48 hr. during which it made 33 circuits of the globe. Aboard the capsule which had refinements to increase reliability, attitude control and impact accuracy were stored several biological specimens to test radiation effects: a three-day-old chicken heart, human bone marrow, human amniotic cells, viruses and bacteria.

Robert E. Gross, board chairman of Lockheed Aircraft Corp., died last week in Los Angeles. A founder of Lockheed, he had been principal executive officer for nearly 30 years. He was 64.

USAF-Martin Titan J-17 missile impacted in the center of a target area 6,069 mi. from the Atlantic Missile Range last week. This was the greatest range yet achieved by the missile.

Senate Foreign Relations Committee last week unanimously passed a bill to create a disarmament agency (AW Aug. 28, p. 21) and both Senate and House are expected to move quickly on the measure, despite resumption of nuclear tests by the U. S. and USSR.

Jacqueline Cochran, president of the National Aeronautic Assn., has claimed a new women's world speed record of 659.6 mph. for the 500-km. closed course. She flew a Northrop T-38 trainer at 40,000 ft. over Edwards AFB, Calif. Previous record was 590.321 mph. set by Miss Cochran on May 23, 1953 in a Canadian-built F-86 Sabrejet. Last month Miss Cochran also claimed a new women's speed record for the 15/25-km. straightaway course (AW Sept. 4, p. 36).

First of Army's new midget Missile Master systems for coordination and control of Nike Ajax and Hercules batteries, has been installed at Turner AFB, Ga. New transistorized version of the Missile Master, known as Birdie (battery integration and radar display equipment) and developed by Martin-Orlando, is housed in transportable shelters and occupies only a small fraction of space of earlier models. Total of 19 systems is on order.

Blount Bros. Construction Co. was low bidder to build Saturn Complex 37 at the Atlantic Missile Range with a bid of $15.2 million.

Italy plans to launch a satellite within two years from a floating platform in the Mediterranean, using a four-stage Scout rocket. No agreement has been signed but U. S. and Italian scientists have discussed the project.

Shift of Government Role in Aviation Seen

Project Horizon report predicts stronger U. S. hand in international affairs but less influence at home.

By David H. Hoffman

Washington—Project Horizon report—a sweeping, 325-page study charting national aviation goals for the coming decade—predicts that the role of the U. S. government will expand in international air transport and export affairs but shrink somewhat domestically.

Recognizing that U. S. civil aviation is a $7-billion industry employing almost 600,000 people and a neglected industry with an untapped potential, despite "75 comprehensive government reports on aviation subjects" in the past 10 years, Horizon urges that the U. S.:

- **Equip all its diplomatic** and technical missions abroad to aid the sales efforts of U. S. manufacturers and airlines by furnishing them with current technical data and informing the manufacturers of unexploited areas of opportunity.
- **Act immediately to restore** competitive equality by ending instances in which foreign carriers are allowed to operate along more favorable routes or at lower fares or with less restrictions than those that are imposed on U. S. airlines.
- **Consider resurrecting** the office of assistant secretary of state for transport and communications, which would give U. S. bilateral negotiating teams "the stature they deserve."
- **Order the Post Office** Department to develop a "fiscally-sound proposal" under which all first-class mail would be carried by air. This plan, including complete cost data, would be submitted to Congress.
- **Appoint a commission** to analyze effectiveness of the Railway Labor Act as amended to cover airlines in an effort to end inter-union deadlocks leading to costly strikes. Recommendations would lead to legislation not later than January.
- **Establish within** Federal Aviation Agency and National Aeronautics and Space Administration top-level departments that would concern themselves solely with general aviation problems and applied research for general aviation aircraft development.
- **Continue research** aimed at producing an economic V/STOL transport, but aside from this research, relegate development of "improved helicopters and other new V/STOL aircraft" to private enterprise.

Ordered by President Kennedy last Mar. 3 and released this week by the White House, the Horizon report devotes the bulk of its space—about 175 pages—to industry activity abroad and to the problems of domestic airlines. Observing that U. S. flag carriers are more efficient in operating their equipment, in pricing policies and in aggressive marketing than their foreign competition, the report warns that the U. S. advantage is being threatened in all these areas.

If the nation's international air transport system is not to go the way of its atrophied shipping industry, thus wasting an important economic and political resource, the U. S. must be "more sensitive" to the relative economic merits of route exchanges. As new nations seek to enter the air transport market, airlines of all countries should make some concessions and not "leave to the American carriers alone the responsibility for yielding part of their markets to the new operators," the report concludes.

Limiting Competition

On the subject of one U. S. flag carrier competing with another abroad, Horizon leans toward limiting their competition without advocating a "chosen instrument" policy, under which a single airline would be selected to fly all overseas routes for the U. S. Unless traffic along a given route could fill a daily jet round trip for each U. S. airline certificated to fly it, the report suggests that the route be assigned to one carrier only.

Horizon contains a reminder that both domestic and international airlines may be forced to undertake costly re-equipment programs in the late 1960s or early 1970s as supersonic transports and new V/STOL aircraft become available. To see how this expected outlay balanced with expected revenues during the 1966-1970 period, the Horizon task force surveyed all trunklines plus Pan American and Panagra.

The survey indicated that total cash generated during those five years would fall $35 million short of industry requirements.

Key to reversing this predicted situation, according to the report, is a tighter capacity control that might lead to higher load factors, giving the airlines more revenue per unit of traffic. Pointing out that primary responsibility for profitable operation must rest with airline management, Horizon also states that Civil Aeronautics Board could help the industry by giving "prompt and sympathetic attention to criteria to be used to assess the value of mergers."

Encourage Mergers

At the same time, CAB should encourage mergers that would eliminate excessive competition or do away with route structures that pit weak carriers against strongly entrenched carriers. It should also refuse to certificate new competition "except where clearly justified on economic grounds" and welcome new tariffs designed to promote new sources of traffic.

Horizon admits that its plan to send all first-class mail by air is not entirely a new one. In 1948, President Truman's Air Policy Commission stated that the "test as to what first-class mail should move by air should be the best mail service to the public." Bluntly, Horizon concludes that "what was true in 1948 is more obvious today with the operation of jet aircraft." The President, therefore, should instruct the Post Office to develop a "package to be submitted to Congress including the price tags, the areas of mail to be serviced, and the impact on its own costs and revenues."

Noting that 40% of airline revenue is eaten up by payroll and that the industry is particularly sensitive to work stoppages—one survey indicates that strikes cost the airlines $150 million in the last five years—Horizon specifically refused to recommend compulsory arbitration. Nor did the report suggest that the Taft-Hartley Act should replace the Railway Labor Act, which now establishes airline machinery for settling strikes.

But it urged that the Railway Labor Act and the procedures developed under it be evaluated. Moreover, the evaluation group should prepare amendments rapidly so that legislation could be introduced in the next session of the 87th Congress, the report said.

Another alternative might be the formation of an airline "tri-partite committee" similar to the one outlined in a recent agreement between the Kaiser

Co. and its steel workers, the report said.

This committee participates in prospective contract bargaining and also assumes the role of mediator or fact-finder as negotiations progress. The newly formed Missile Labor Board, with its membership equally divided among labor, industry and the public, is a similar tri-partite group that the airlines might well examine.

Aeronautical Research

Horizon feels that no longer can civil aviation rely on the "by-products of military-related research and development programs" because of the armed services' increased emphasis on the use of missiles.

"There is no question," the report states, "that aeronautics is running a poor second to space technology in the time, talents, facilities and funds expended on it within National Aeronautics and Space Administration."

To ease this problem, Horizon would shift most basic research to universities and private organizations and, at the same time, establish a senior technical group in NASA to lead the entire aviation community in aeronautical research and development.

An aeronautical scientist with the rank of director, not an engineer, would head this group.

Fred M. Glass, executive vice president of the Hertz Corp., was chairman of the eight-man Horizon task force. Its report, at least as thorough as any earlier aviation study, includes these other recommendations:

- **U. S. should re-examine** the restrictions placed on export of aviation products. Focal point should be items that no longer have strategic importance because of advances in the state of the art.
- **Congress should either** repeal the 10% tax on air transportation or earmark revenues thus obtained to support the air traffic control system. In Fiscal 1961, this tax brought in $163.6 million while it is estimated the system will cost $431.4 million to operate in Fiscal 1962.
- **FAA should establish** within itself a Federal Aviation Service to man the entire air traffic control system in peacetime. Automatically, this service would become part of the military during war or national emergencies.
- **Rules and regulations** governing general aviation should be simplified or eliminated whenever possible. Similarly, for general aviation's benefit, low frequency radio ranges should be retained if more suitable than Vortac at a given location.
- **Broader civil use** of surplus military air bases should be sought and their availability made known for planning purposes at least three years prior to deactivation. Regulations governing emergency civil landings at military fields should be relaxed and joint civil use of these fields expanded.
- **Government should continue** to subsidize development of new all-cargo transports, such as the Lockheed C-141, that are designed from the ground up to meet both military and civil certification requirements.
- **Legislation should be enacted** giving CAB the power to certificate new classes of air service and control over the so-called Part 45 or contract carriers now answerable only to Federal Aviation Agency.
- **All restrictions** that result in added airline costs and inferior services should be eliminated but minimum and maximum rate controls should be retained by CAB. The Board, however, should permit the carriers wide latitude in pricing their services.
- **U. S. technical aid** to emerging or underdeveloped nations anxious to establish air transportation systems should be expanded. Major goal should be to emphasize a systems approach that would transfer ownership and control to the new nation as rapidly as possible.
- **Federal aid to airports** should be stepped up and FAA allowed the widest latitude in allocating funds on the basis of local need, rather than local political interests. Funds should be committed as far ahead as possible.

Industry Reaction

Industry's first reaction to the Horizon report seemed to center on the section that would revise both the structure and the organization of NASA. Not only did the report recommend the formation of a "senior technical group" within NASA, it also asked that an "advisory board" composed of leading aeronautical scientists outside the government be set up to furnish this group with "mature judgment, advice and counsel."

The technical group and the advisory board would determine "the preferred level of effort in aviation research and development, and the preferred distribution of this effort among the several scientific disciplines and among basic research, applied research and development."

Some observers commented after Horizon's release last week that implementation of the report would work to transfer some research responsibility from FAA's Bureau of Research and Development to NASA. Supporting this view is a section of Horizon that suggests the NASA technical group should "continuously monitor the basic research sponsored by the Department of Defense and other government agencies." This, Horizon feels, would ensure that aeronautical technology would profit to the maximum from missile, space and electronic research progress in the U. S.

Because of the national preoccupation with space and missiles, Horizon reasons that aeronautics will always be neglected within NASA unless it is given new and formal status. Elevating the head of NASA's aeronautical research branch to director's rank would give this function more appropriate "financial and management support."

FAA, Horizon states, should support this NASA activity in accordance with its statutory authority by pursuing "aeronautical development directed to increased safety and efficiency." The report adds that "with respect to the air traffic control, navigation, communications and other research now carried on in the Bureau of Research and Development of the FAA, the effort should be reoriented in accordance with the changing requirements and technology in air traffic control and related systems.

Turning to the problems of the U. S. airframe industry, Horizon recognizes that more and more company resources will be required to develop future military projects. As the cost and complexity of civil systems and equipment increase, this fact may lead to "a decrease in the amount of attention and resources devoted to major development programs involving exclusively civil aviation products."

Supporting this predicted trend is the fact that the four largest U. S. manufacturers of turbojet and turboprop transports have thus far written off more than $800 million in losses.

The supersonic transport will require far greater financial resources—$500 million to $1 billion in development costs according to most estimates. At the same time, the technical problems involved are also larger and the potential market relatively meager. This means that government aid must supply the impetus for an early launching of the program, according to Horizon.

Industry Capability

The V/STOL transport, however, is well within the financial and technical capability of the industry, according to the report. The transport's development costs will range from $50 million to $100 million. Reasons for present hesitation, Horizon feels, are the market's questionable status, the unknown capabilities of various design approaches and a tendency to await final military decisions. As a result, manufacturers are spending relatively little on technical studies and experimentation. Nevertheless, direct government subsidizing of the V/STOL program probably will not be necessary, Horizon concludes.

Airlines Block Adoption of Radio Treaty

By Katherine Johnsen

Washington—Senate Foreign Relations Committee last week abandoned efforts to obtain ratification this session of treaty regulations that would allocate for the first time radio frequencies for world-wide use in space research and radio astronomy.

Opposition stirred by airline interests appeared to make hopeless any attempt at ratification, which requires a two-thirds Senate vote.

Telecommunications officials of State Department, National Aeronautics and Space Administration and Federal Communications Commission expressed "very, very great concern" at the failure. It places the U. S. in a difficult position because this country is now initiating negotiations with other nations aimed at obtaining international frequency allocations for operational meteorological, navigational and communications satellite systems at a 1963 conference of the International Telecommunications Union.

The interest of the vast majority of countries is in allocations for political broadcasting. It took considerable convincing on the part of the U. S.—with some help from the USSR and Great Britain—to obtain 13 allocations for space research in the treaty, which was drawn at the 1959 ITU meeting. It was submitted to the Senate too late in the 1960 session to receive consideration.

It is anticipated that other countries will now be even more skeptical as to the need for additional space frequencies when the U. S. has not ratified use of the allocations already available internationally.

The practical result of the failure to ratify is that NASA and other government agencies will be saddled with months of red tape, negotiating bilaterally with other nations to obtain frequency clearances for space projects and listening points located in Australia, Africa, South America, and Canada.

Ironically, Air Transport Assn. and Aeronautical Radio, Inc., (Arinc), leading the airline opposition, are strongly in favor of the treaty regulations as formulated at the 1959 ITU conference in Geneva. In addition to setting aside frequencies for space and radio astronomy, the treaty establishes the 8,800 megacycle band world-wide for aeronautical radio navigation—on an equality basis with radio location. This is the band in which the doppler radar navigation system—now being installed and programed for installation in the airlines' jet aircraft—must operate.

What the airlines object to is the manner in which Federal Communications Commission plans to implement the treaty. FCC's proposed rule, issued last Feb. 22, would allow airline use of the frequency only on a "temporary" and "secondary" basis. Airline spokesmen claim the intention is to withdraw the band completely from commercial aviation use—probably shortly after the treaty regulations are ratified—on the grounds that it is needed for national security.

This would mean a major loss to carriers such as Trans World Airlines, which has already invested almost $2 million in doppler systems. Other carriers hesitate to move forward with their doppler programs. Pan American Airways, for example, so far has invested a few hundred thousand dollars in doppler systems, but wants to install dual dopplers—one device for operations and one for standby—in all of its jet fleet of 50-plus aircraft. Pan American is operating six Canadian Marconi dopplers on Boeing 707s and is evaluating systems manufactured by Bendix Corp. and Collins Radio Co.

ATA estimates that the planned airline investment in doppler installations totals over $10 million. This would be the cost of equipping all aircraft specifically constructed for the system, delivered or scheduled for delivery by the end of the year. Doppler systems are expected to cut fuel costs substantially, make more traffic possible over dense routes, and improve air safety.

Airlines presently have only temporary access to the 8,800-mc. band. Their position is that they do not want this temporary basis perpetuated by an FCC rule implementing the treaty.

To preclude this, ATA and Arinc unsuccessfully urged Senate Foreign Relations Committee to attach a resolution to the treaty expressing "the interpretation and understanding of the Senate" that the 8,800-mc. band is allocated for airborne doppler on a shared basis with radio location "as pro-

North Atlantic Slump Continues

New York—North Atlantic airline passenger traffic, continuing to reflect a critical excess of capacity, dropped slightly in eastbound service during July despite an increase over the previous July of about 39% in seats offered. The carriers handled 127,438 eastbound passengers during July, 1961, compared with 127,650 passengers in July, 1960. Westbound total was up from 99,672 to 111,094 passengers.

July load factors for 1961 were 58% eastbound and 50% westbound, compared with 80% eastbound and 64% westbound for the previous July.

First-class traffic was off in both directions from the previous July. Eastbound first-class passengers in July, 1961, totaled 12,084, down from 16,587; westbound first-class total was 11,277, down from 13,217 passengers. Economy total was up from 111,063 to 115,354 eastbound and from 86,455 to 99,817 westbound passengers.

Figures for the two weeks ending Aug. 12, 1961, indicate load factors of 42% eastbound and 63% westbound. Passengers totaled 41,694 eastbound, with 99,721 available seats. Westbound totals for the two weeks were 63,714 passengers and 100,866 seats.

For the entire month of August, 1960, the North Atlantic carriers achieved load factors of 47% eastbound and 89% westbound.

Here is a breakdown of the July results for eastbound North Atlantic traffic:

Carriers	Flights	Seats	Passengers	Load Factors
Air France	129	18,262	8,948	49%
Air-India	22	2,888	1,498	52
Alitalia	74	9,910	6,657	67
BOAC	201	25,937	15,346	59
Canadian Pacific	43	5,094	2,655	52
El Al	42	5,130	4,139	81
Iberia	18	2,196	932	42
Irish	45	5,643	4,370	77
KLM	152	17,516	10,101	58
Lufthansa	98	13,786	8,342	61
PanAm	361	44,955	25,265	56
Qantas	9	828	398	48
Sabena	63	8,932	4,320	48
SAS	109	14,126	8,710	62
Swissair	66	8,448	4,539	54
Trans-Canada	94	11,920	8,106	68
TWA	182	25,068	13,112	52
Totals:	1,708	220,639	127,438	58%

vided by the treaty, and that no rule or rule-making action of the Federal Communications Commission contrary to this declaration is authorized."

Sen. William Fulbright (D.-Ark.), chairman of Foreign Relations, said a domestic controversy between airlines and FCC is not within his committee's jurisdiction. Senate Commerce Committee also declined to consider the matter on the ground that the treaty is a matter for Foreign Relations and allocation of frequencies is a function of the executive branch, not Congress.

The heart of the issue is whether Defense Department, primarily Air Force, is to have domination—or monopoly—of the 8,800-mc. band for classified air defense radar uses and doppler systems in its strategic and tactical aircraft for radio location of targets, as well as for doppler systems for air navigation in its transport aircraft. Navy has developed a radar air navigation system utilizing the 13,000-mc. band.

The FCC rule is based on a recommendation of the Interdepartment Radio Advisory Committee of Office of Civil and Defense Mobilization, which exercises the President's authority to occupy frequencies for government agencies. The IRAC recommendation, in turn, is based on Defense requests.

Airline strategy of blocking ratification, instead of trying to soften FCC, IRAC, and Defense to a compromising attitude, appears to have antagonized and stiffened resistance to concession. After a re-evaluation, defense and IRAC re-asserted the government requirement for dominance of the 8,800-mc. band, in a report to FCC and Senate Foreign Relations.

One official indicated things will be done differently next year. "We have been sitting back while the airlines use their club," he said. "But once we push a button, and make it clear to the Senate that the U. S. space program requires treaty ratification and national security requires the 8,800-mc. band, I think we'll win out with ease."

In testimony to Senate Foreign Relations, John E. Stephen, ATA general counsel, declared FCC's implementation rule is "unnecessary, it is unreasonable, and it is directly adverse to the public interest in a safe and reliable air transport system." He said it means that "the multitudes of military aircraft—U. S. and foreign—flying to or transiting the U. S.—will be equipped with and will use 8,800-mc. dopplers. Hundreds of aircraft of the 45 foreign flag airlines flying to or transiting the U. S. will have similar equipment on board and will make similar use of it. Only the U. S. flag airlines will be prevented from using this valuable navigating device. It is difficult to conceive of a more unreasonable and arbitrary action."

Richard N. White, TWA manager of electronics development, pointed out that "self contained" doppler radar, which does not require use of any ground radio aid, offers reliable and accurate navigation over oceans, mountains, jungles, deserts, Arctic tundra, and other sparsely populated areas where no other navigation is available. He reported that tests show that with doppler systems, the present 300-mi. spacing between aircraft over the North Atlantic can be reduced to a third, or 100-mi., making more service available, "and the safety and reliability of that service will be improved."

Donald C. Beelar, representing Arinc, challenged the Defense Department argument that airline doppler systems would interfere with its defense radar and other radio location activities. He said Federal Aviation Agency supports this view. "Another demonstration of sharing is the fact that several hundred systems of 8,800-mc. dopplers are in operation in government aircraft, military and civilian," Beelar testified. "It is understood that a substantial procurement program is under way for new production of 8,800-mc. dopplers in government aircraft."

Bendix Radio Division of Bendix Corp., and GPL Division of General Precision, Inc., manufacturers of doppler systems, supported the airline position in Senate testimony. In addition to supplying TWA, United Air Lines, Western Air Lines, and Pan American, Bendix reported that it has firm orders for 8,800-mc. dopplers from SAS, Swissair, Japan Air Lines and El Al Israel Airlines.

RAF Decision to Buy Five VC.10s Increases Vickers' Orders to 57

Farnborough—Vickers VC.10 four-jet transport program last week got a much needed boost from the British government when Royal Air Force ordered five airplanes to beef up its Transport Command.

Government support, confirming Aviation Week's prediction (AW Aug. 7, p. 50), is in addition to the VC.10s being built for British Overseas Airways Corp., which will get priority on the production line.

The RAF order is worth about $29 million and delivery will be in 1965. The RAF move brings VC.10 orders to 57. BOAC will buy 45, of which 30 are Super VC.10s. Ghana Airways has ordered three and British United Airways four.

Transport Command presently is equipped with 10 de Havilland Comets, 23 Bristol Britannia turboprops, plus about 50 Beverleys and 60 Hastings. Beverley is due for replacement, and competition for a short takeoff and landing (STOL) replacement probably will center on a competition between a British design—possibly the Bristol 208—and the Lockheed BLC-130, powered by Rolls-Royce Tyne engines. Decision on the competition is expected soon.

Interest in jet transports also is being shown at the Society of British Aircraft Constructors' 22nd annual display here by executives of LOT, the Polish airline, which is known to have discussed long-range jet operations with BOAC (AW Apr. 14, p. 39). LOT's Director General Jan Krzywicki, accompanied by V. Papielas, the Polish minister of communications, visited British Aircraft Corp. and Vickers VC.10 design and sales personnel. LOT has held preliminary talks with BOAC, partly on discussions of a pooling agreement in case the airline enters the North Atlantic passenger field.

Another possibility for expansion of the British transport field, first outlined here by Short Brothers & Harland's Director H. G. Conway, is that BOAC may buy several Belfast freighters for the North Atlantic cargo routes. Conway said the double-deck and swing nose versions of the Belfast SC.5 (AW May 15, p. 47) have received "considerable interest."

Transport effort was mostly held to model displays. These included:

- **British Aircraft Corp.'s BAC 111** short- to medium-haul twin-jet transport, ordered by British United Airways, and, in the U. S., by Ozark and Frontier. Negotiations with Braniff are now in advanced stages. Display mockup has been completed at Vickers' Weybridge plant, and an engineering mock-up is under construction at the Hurn production facility.
- **Civil version** of the Short Belfast, powered by four Rolls-Royce Tyne turboprops, which can carry up to 201 passengers.
- **Vickers VC.10,** carrying 135 passengers, and the Super VC.10, carrying up to 163 passengers. Both are powered by Rolls-Royce Conway RCO.42/2 bypass turbine engines.
- **De Havilland Trident,** three-jet transport which recently rolled out at the Hatfield plant and which will make its first flight this winter. The airplane has been ordered by British European Airways. Powerplants are three Rolls-Royce Spey bypass turbines. Armstrong Whitworth limited its flight display to the AW 660.

Atlantic Situation Forcing Policy Decisions

By L. L. Doty

Washington—Rapid expansion of seat capacity on North Atlantic routes and a consequent decline in load factors is forcing the U. S. to make certain moves that indicate the direction it may take in establishing an international civil aviation policy.

Although the government does not want to take any action until current research studies on international air transportation are completed, the bitterness between the U. S. and a growing number of foreign nations precludes postponing many of the issues even for several months.

Future policy hinges on a White House study being conducted by a committee headed by Najeeb Halaby, Federal Aviation Agency administrator. Study is to be completed by the end of the year (AW Aug. 22, p. 49).

Immediate Pressures

Nevertheless, because of immediate pressures, certain decisions necessarily have been made in the past few months that suggest these factors will form a part of the U. S. policy:

- **Direct competition between** U. S. airlines on international routes will be eliminated. To achieve this without discarding the element of free enterprise, the U. S., rather than adopt the "chosen instrument" device, will apply the "area concept" in assigning routes. Under this plan, two or more U. S. carriers may serve Europe, for example, but no one European port of entry would be served by more than one U. S. airline. Project Horizon recommends assignment of routes according to a traffic formula.
- **Free enterprise system** will prevail as a basic U. S. principle in the future development of competition with foreign carriers, but attempts to place some control over capacity offered by foreign flag carriers through U. S. interpretation of Bermuda-type bilateral agreements will be pressed.
- **Bilateral agreements** will come under extensive review but it is unlikely these agreements will be scrapped and renegotiated to strengthen the competitive position of U. S. carriers.

CAB's Concern

In recent months, the Civil Aeronautics Board has issued two highly significant orders that, because of their far-reaching influence on international operations, must be taken into consideration in the development of any new policy. The first order, calling for an investigation to determine whether foreign air carrier permits should be revised to require the exchange of traffic and schedules data with the U. S., has brought sharp rebukes from a large number of foreign flag carriers.

The second order, directing that an investigation be held to determine the practicability of establishing two main South American routes to be served by only two U. S. airlines, has drawn criticism from U. S. carriers. It is now known that the Board will soon launch a similar investigation of transatlantic routes (AW Aug 28, p. 45).

Thus it can be seen that the Board is seriously alarmed over the competitive problems facing U. S. carriers and wants traffic and schedule data of foreign flag carriers to determine whether capacity clauses of bilateral agreements are being violated. It is also obvious that the Board feels the competitive impact of the high seat-capacity of jets can be eased if direct competition between U. S. carriers is all but eliminated.

On the latter point, it now appears to most observers that the Board will be successful in realigning foreign routes for U. S. carriers, particularly if it can prove—which it probably can—that such adjustments are in the public interest. Certainly, if any U. S. carriers seek subsidy as a result of an over-abundance of competition, which more than one carrier has already suggested may be the immediate result of declining business, the Board then will be forced into such action.

Chances are good, also, that the Board will be able to enforce an exchange of traffic and schedule statistics with other nations. Whether it will be able to apply this information as a means of controlling capacity is something else again.

Foreign Opposition

There is strong evidence that at least six European transatlantic operators have tacitly agreed to unite in opposition to U.S. moves to enforce its interpretation of bilateral agreements on foreign nations. The new interpretation is a complete reversal of the original U. S. stand on bilateral agreements and so far it has produced nothing more than antagonistic response from foreign countries.

Until a few years ago, the U. S. was a strong advocate of the open-skies, free competition principle and applied this principle in the development of foreign routes. It is now, at least temporarily, a proponent of restrictionism and insists that the capacity clauses of bilateral agreements provide for such control. Most foreign carriers, once supporters of regulation, have also reversed themselves and now back the free-competition policy.

Attempts by the U. S. within the past year to enforce such control on SAS and KLM were notable failures despite the bait of a Los Angeles route held out to KLM, with the condition that that airline restrict its capacity in return for the West Coast route. SAS and KLM were backed by the British government in their resistance to U. S. pressure for control.

In effect, this country now stands alone in its new interpretation of capacity clauses, and there are many airline authorities in the U. S. who feel this stand is untenable. They hold that the U. S. is bypassing the original "spirit and intent" of bilateral agreements by charging foreign carriers with violating the agreement because of their refusal

Transatlantic Scheduled Operations
Growth of Capacity Since Introduction of Jets
June 1961–June 1958

(Jets First Introduced on Routes in October, 1958)

	Scheduled Flights		Seating Capacity		Revenue Passengers		Load Factor %	
	1961	1958	1961	1958	1961	1958	1961	1958
Air France	138	106	18,390	7,399	10,624	6,393	57.7	86.4
Alitalia	79	34	9,501	2,263	6,564	1,951	69	86.4
BOAC	195	157	24,249	10,829	14,312	9,323	59	86.1
Lufthansa	111	73	13,416	5,117	9,592	4,725	71.5	92.3
El Al	32	21	3,493	1,848	2,649	1,612	75.8	87.2
Iberia	13	17	1,027	1,258	582	873	56.6	69.4
KLM	109	125	10,627	8,555	7,666	7,202	72.1	84.2
Pan American	382	415	42,394	26,536	27,693	20,958	65.3	79
Qantas	9	9	828	582	367	428	44.3	73.5
Sabena	68	100	8,852	7,904	4,759	6,622	53.8	83.8
SAS	114	169	14,827	10,777	11,308	9,664	76.3	89.7
Swissair	67	56	8,608	3,539	5,526	3,272	64.2	92.5
TWA	195	271	23,945	19,146	15,597	14,322	65.1	74.8
TOTAL	1,629	1,581	187,765	105,753	122,487	87,345	65.2	82.6

Note: Air-India and Irish Air Lines are omitted because of lack of comparative figures.

to control capacity. Ironically, both Peru and Ecuador are now accusing the U.S. of violating its agreements with them for the very same reasons that the U.S. is accusing SAS and KLM of violations. And both Peru and Ecuador have produced telling traffic statistics to back their charges against the United States.

In taking its stand, the U.S. has been prodded into action by the airline industry, which holds that foreign flag carriers are carrying more than their rightful share of direct transatlantic traffic, handling more Fifth Freedom traffic than they are entitled to and that they are siphoning off traffic from domestic carriers.

Revisions Doubtful

It is also now considered doubtful that the U.S. will attempt to make any drastic revisions of bilateral agreements, since the vast majority of U.S. rights were obtained immediately after the war when this country was in excellent bargaining position. Now with the exception of India, Japan and several South American countries, for example, the U.S. has operating rights to, from and beyond every major foreign country in the free world.

There are some exceptions in which the U.S. has been frustrated in extending its routes to an ideal degree. Northwest's failure to win entry into Hong Kong and TWA's failure to close the route gap between Frankfurt and Zurich are two significant cases in point. However, the only three countries which have refused "beyond rights" to the U.S. are Finland, New Zealand and South Africa.

U.S. strength in renegotiating bilaterals lies in the reallocation of U.S. ports of entry within the U.S. to foreign flag carriers. Chances are strong that a move will be made to redistribute U.S. cities served by foreign airlines and restrict the number of such cities assigned to each airline.

Recriminations Feared

But serious consideration will be given to recriminations that might result if such an adjustment of gateways is tried. The Board and the White House confirmed this fear in the decision on the Eagle Airways Bahamas-Florida Case which was signed by President Kennedy last March 13. In part, the decision read:

"The public interest in the development of an air transportation system properly adapted to the present and future needs of our nation lies with the avoidance of conduct which, by example, could invite other carriers to scale down the rights of our . . . carriers to fit the generally more modest competitive abilities of their own aviation enterprises."

Aeroflot Favors Pools To Limit Competition

Washington—Aeroflot, Russia's state-owned airline, has voiced a strong preference for airline pools as a means of limiting competition over international routes which it flies jointly with foreign carriers.

V. Danilychev, chief of Aeroflot's international operations, praised such agreements now in effect with Czechoslovak Airlines, East Germany's Deutsche Lufthansa, British European Airways and Air-India International, in an article written for Aeroflot's official publication, Grazhdanskaya Aviatsiya.

Emphasizing the economic advantage of pooling all revenues for distribution on a previously determined ratio, Danilychev pointed out that participants "are mutually interested in having all aircraft, regardless of their ownership, loaded to the maximum. At the same time, advertising expenditures are considerably reduced."

Danilychev also indicated that Aeroflot favors standardized rules covering the international transportation of passengers and cargo. Despite Russia's refusal to join either the International Civil Aviation Organization or the International Air Transport Assn., Aeroflot operates under transportation regulations which differ very little from those observed by foreign carriers, he noted.

Airport Aid Measures Diverge on Financing

Washington—Widely varying bills to provide federal grants for community airports went to a House-Senate conference last week with the financing method the key issue.

The House on Aug. 1 passed a bill authorizing $375 million over five years in federal grants to states for airport construction and improvement, the amount requested by President Kennedy. But the House version makes the program dependent on year-to-year appropriations of the congressional committees (AW Aug. 7, p. 30).

President Kennedy requested authority to enter into long-term contracts with communities to give them assurance that federal grants for airports would be forthcoming. Under this arrangement, the Federal Aviation Agency could get the airport money directly from the Treasury if Congress refused to appropriate it.

The Senate on Sept. 1 passed a bill including this long-term contract authority. The Senate rejected two amendments by Sen. William Proxmire (D.-Wis.) to eliminate the contract authority and to reduce the federal funds authorized over five years from $375 million to $261 million. An amendment was adopted requiring the FAA administrator to give "fair consideration to the interests of the communities in or near the project" before approving the construction of an airport.

The amendment, offered by Sen. Kenneth Keating (R.-N.Y.), was prompted by the controversy surrounding the FAA's proposal to reserve part of Mitchel Field on Long Island for a general aviation airport. The House-passed bill provides that the airport shall not be built if the Nassau County Board of Supervisors objects.

Mohawk Gains Cities But Is Denied Subsidy

Washington—Civil Aeronautics Board has approved transfer of nine cities on Eastern Air Lines routes in New York and Vermont to Mohawk Airlines on a nonsubsidy basis, but it rejected Mohawk's bid to operate between Montreal and Ottawa, Canada.

The Board's decision in the Eastern-Mohawk Transfer Case gave Mohawk four new points on its system—Rutland and Burlington, Vt.; and Saranac Lake-Lake Placid and Plattsburgh, N. Y. The other cities, Poughkeepsie, Albany, Glens Falls, Watertown and Massena, N. Y., were formerly served by both airlines before Eastern transferred its authority to Mohawk.

CAB rejected Mohawk's subsidy bid for the new routes because they were profitable for Eastern and the Board saw no need for additional payment. But the Board noted that Mohawk could apply for subsidy later. In the same decision, CAB designated Ogdensburg-Massena as a hyphenated point to be served by a single airport under the Board's regional airport concept.

Aerolineas Renewal Favored by Examiner

Washington — Aerolineas Argentina, the flag carrier of Argentina, has won an initial victory in its bid for renewal of a foreign air carrier permit between Argentina and New York.

Rejecting the complaints of Pan American World Airways, Civil Aeronautics Board Examiner Leslie G. Donohue recommended a three-year renewal of the foreign airline's authority to provide the service.

Donohue noted that, while Pan American requested that the renewal be conditioned on certain safeguards against rate cutting, the Argentine government also has the power to control rates and fares charged by U. S. airlines serving Argentina, but has never exercised the right.

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TWA Orders 20 Caravelles

Washington—Trans World Airlines has signed a firm order for the purchase of 20 Sud Aviation Caravelle 10As and an option for 15 more, Charles C. Tillinghast, Jr., president, said last week. Delivery of the first of the twin-turbojet aircraft is expected by Jan. 1, 1963, with the balance of the first 20 by July.

Details of the $100 million order, which includes spares and engines, were finalized at a meeting with Georges Hereil, president and general director of Sud Aviation, Donald Douglas, Jr., president of the Douglas Aircraft Co., and Neil Burgess, general manager of the General Electric Co.'s commercial engine operation division. Financing arrangements for the purchase are not yet settled, Tillinghast said.

Under a prior agreement with Sud Aviation, Douglas will be the sales and service representative for the French aircraft manufacturing firm. Sud will manufacture the airplanes.

The new Caravelles will be the first aircraft to use the General Electric CJ-805-23C aft fan engines (AW Aug. 21, p. 49). Other equipment specified by TWA includes the installation of DME (distance measuring equipment) and radar.

Ability of the Caravelle 10A to operate from 5,000-ft. runways was one of the reasons cited by the airline for the purchase decision. With a range of up to 1,000 mi., the aircraft has a normal operating altitude of about 30,000 ft. and a top cruise speed near 550 mph. Tail loading ramp for passengers is also expected to simplify ground handling procedures. In its configuration for TWA, the turbojet will accommodate 68 first-class passengers or 85 tourists.

The airline now operates 27 Boeing 707s, has 26 more turbofan models on order, is taking delivery on 20 Convair 880 turbojets and is leasing four Boeing 707Bs, pending deliveries of the turbofan-equipped Boeings.

Navigators Consider Striking TWA Over Adoption of Doppler System

Washington—Trans World Airlines faces a possible strike on its international flights before the end of this month as the company's navigators make a last ditch attempt to delay expected adoption by TWA of the doppler radar navigation system.

Spokesmen for the Airline Navigators Assn., an affiliate of the Transport Workers Union, say they have assurances from both the International Assn. of Machinists and the Flight Engineers International Assn. that ANA picket lines will be respected.

FEIA, which struck TWA and five other major airlines last February in a labor dispute with the pilots over cockpit jurisdiction, verified the ANA statement, saying that its support would be in keeping with its "specialist crew member" concept.

Bargaining sessions between the navigators and TWA have broken off, and ANA members are now flying under the 30-day cooling off period required by the Railway Labor Act before strike action can be taken. Terms of the present contract, open since Aug. 31, fail to give the navigators adequate protection against the technological unemployment that adoption of the doppler system and its planned use on the copilots' instrument panel will cause in the future, ANA contends.

The union's immediate concern centers around a final series of tests on the system, which has been modified in accordance with a Federal Aviation Agency recommendation, as a prerequisite to final approval by FAA. Approval, based on final flight tests scheduled to begin this week, could result in adoption by TWA and the legal abandonment of navigator duties on 12 doppler-equipped Boeing 707s before the union has an opportunity to resume negotiations on a new contract, ANA fears. FAA last week approved the system in principle and said final approval will depend on refinement of procedures and satisfactory completion of a pilot training program.

Violations of its present contract, which ANA contends the airline has committed, include permitting supervisory personnel to assume navigational duties during the experimental testing of doppler and a later failure of the company to hold these tests to a mutually agreed limit of one flight per week.

After more than 76 flights had been made, FAA notified TWA that it would not approve the use of doppler alone for primary navigational purposes, ANA said. But in a letter dated Aug. 24, FAA said it would consider approval if the system were used in conjunction with Edo Loran, ADF, VOR and Console radio aids, plus ground and airborne radar equipment, ANA said.

On the basis of the FAA notice TWA re-filed its request in accordance with the recommendations, and has scheduled a final series of six round-trip test flights across the North Atlantic between Sept. 10 and 15, ANA said. Should the equipment meet the approval of both pilots and FAA inspectors, permission to drop the navigator as a crew member on dual doppler-equipped turbojets probably will be granted by FAA, the union said.

ANA has questioned the accuracy of the doppler system, claiming that several transatlantic flights have missed their landfall by as much as 40 mi. Since the equipment has been used as a "go-no-go" item by TWA, there have been lengthy delays in departures because of maintenance problems, the union said.

Higher Coach Fares Denied to Northwest

Washington—Civil Aeronautics Board is standing fast in its opposition to any significant increase in coach fares, despite the steady decline in the airline industry's total earnings and a dramatic climb in coach traffic.

Northwest Airlines is the most recent carrier to have an increased turbojet coach tariff suspended by the Board before it could go into effect on Sept. 3.

Fares proposed by the airline between Spokane, Baltimore, Chicago and Detroit would have been increased in varying amounts ranging from $2 for the shorter flights to $4.60.

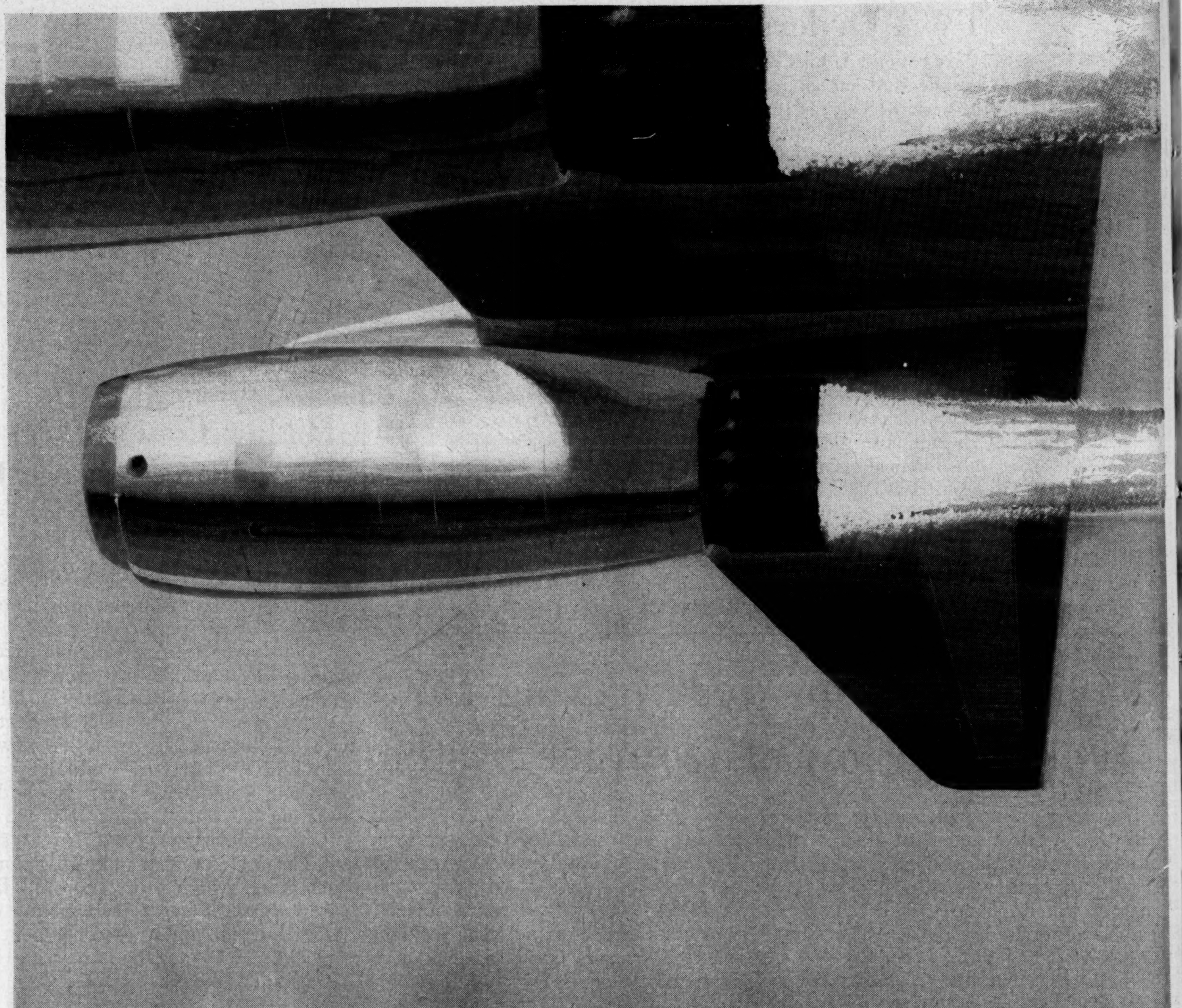
The Board ordered an investigation to determine whether the proposed fares are "unjust or unreasonable," and emphasized that the fares would have exceeded 75% of the first-class fare charges on the same routes.

PanAm Gains Time To Dispose of Stock

Washington—Civil Aeronautics Board last week gave Pan American World Airways two more years in which to dispose of 400,000 shares of National Air Lines stock held by the carrier.

National, which owns an equal amount of Pan American stock under a transfer arrangement ultimately rejected by the Board nearly two years ago, was given the same opportunity, but has already taken initial steps to make a public offering of the holdings.

Both carriers were ordered by CAB to dispose of the mutually exchanged stock more than a year ago, but Pan American objected that the falling market valuation of the National stock would result in an "excessive loss" on the sale by Pan American. The Board's latest offer, which must be answered by both airlines by Sept. 25, gives Pan American a chance to "experience a full cycle of stock market activity ups and downs," said CAB.



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CAB Probers Seek Clues to TWA Crash

Washington—Civil Aeronautics Board accident investigators continued to sift the wreckage of a Trans World Airlines L-049 Constellation last week in search of a clue to the crash of the aircraft only 3 min. after takeoff from Chicago's Midway Field on Sept. 1.

Seventy-eight persons, including five crew members, died as the Boston to San Francisco coach flight dived into a cornfield near Hinsdale, Ill.

Board investigators, aided by the Federal Aviation Agency and other technical experts, have recovered most of the accident debris, which was concentrated in a close, relatively small area, indicating a steep dive angle.

Sections of the tail assembly, however, were found nearly 300 yards from the main impact area, Board spokesmen said. One of the larger portions of this wreckage was the right vertical stabilizer, complete with rudder and trim tabs—leading investigators to believe that these sections were among the first to separate from the aircraft.

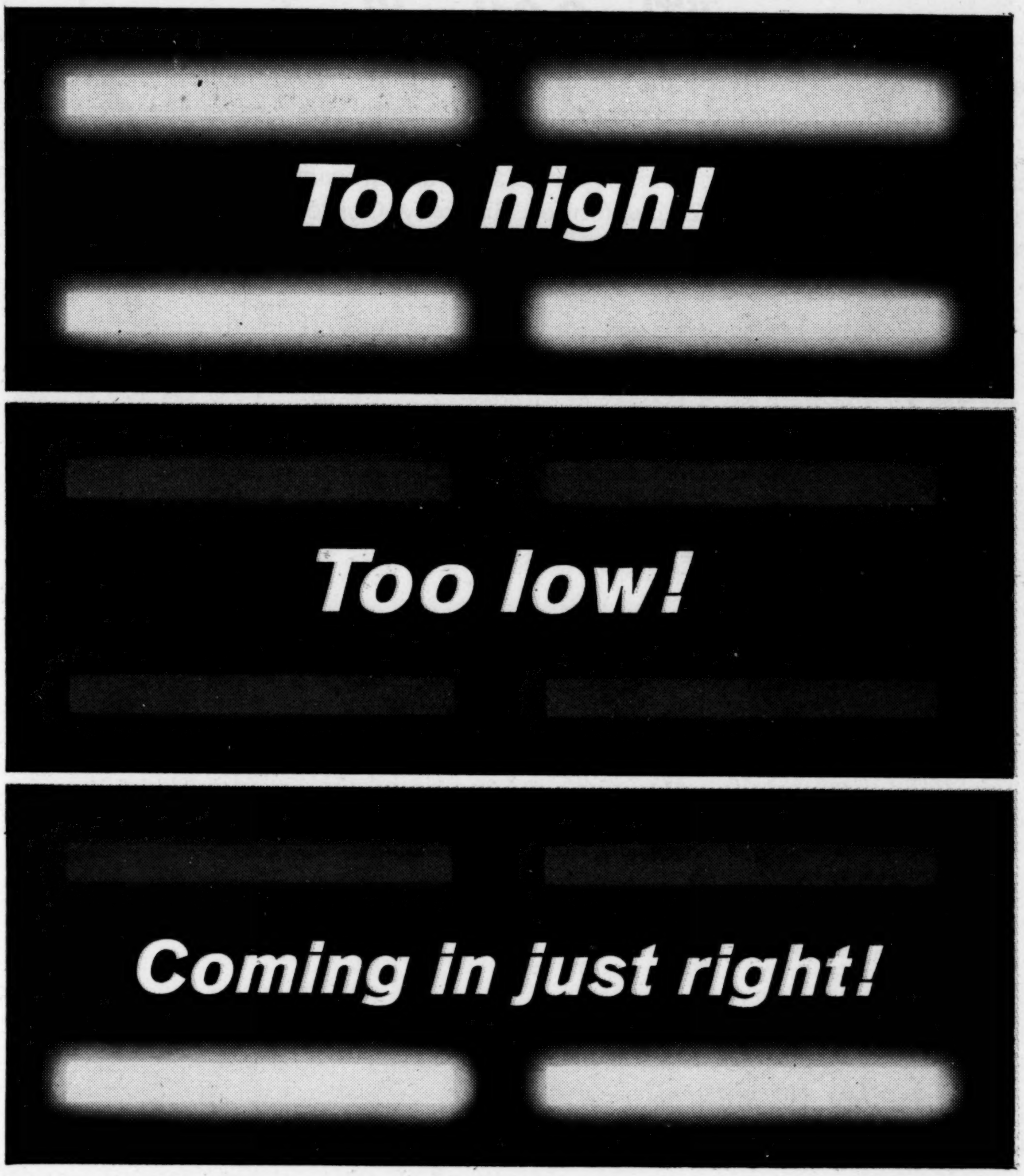
On the theory that there may have been structural failure of the tail assembly, FAA asked TWA and several supplemental carriers to inspect all Model L-049 Constellations for any sign of tail assembly metal fatigue. The inspection order was described as "purely precautionary."

While the investigation is still in an early stage, CAB indicated it does not suspect sabotage. Reports that an unidentified ham radio operator heard the pilot issue an emergency call to the airport tower were rejected. Tape recordings from the tower indicate the last message from the aircraft was acknowledgement of clearance, and investigators were also unable to locate the alleged ham operator.

Airlines May See Early Tri-Service VTOLs

Washington—Advance models of the tri-service VTOL transport probably will be made available to commercial carriers so their suggestions can be incorporated in later production models, Federal Aviation Agency Administrator Najeeb E. Halaby said last week.

Halaby told the Army Aviation Assn. of America here that the Army's light observation helicopter program (LOH) probably would provide civil aviation with its "first real economical" small helicopter. He also said that FAA now is cooperating with Army on engineering studies that will lead to FAA certification for the aircraft. The same approach, Halaby said, is being followed with the VTOL transport.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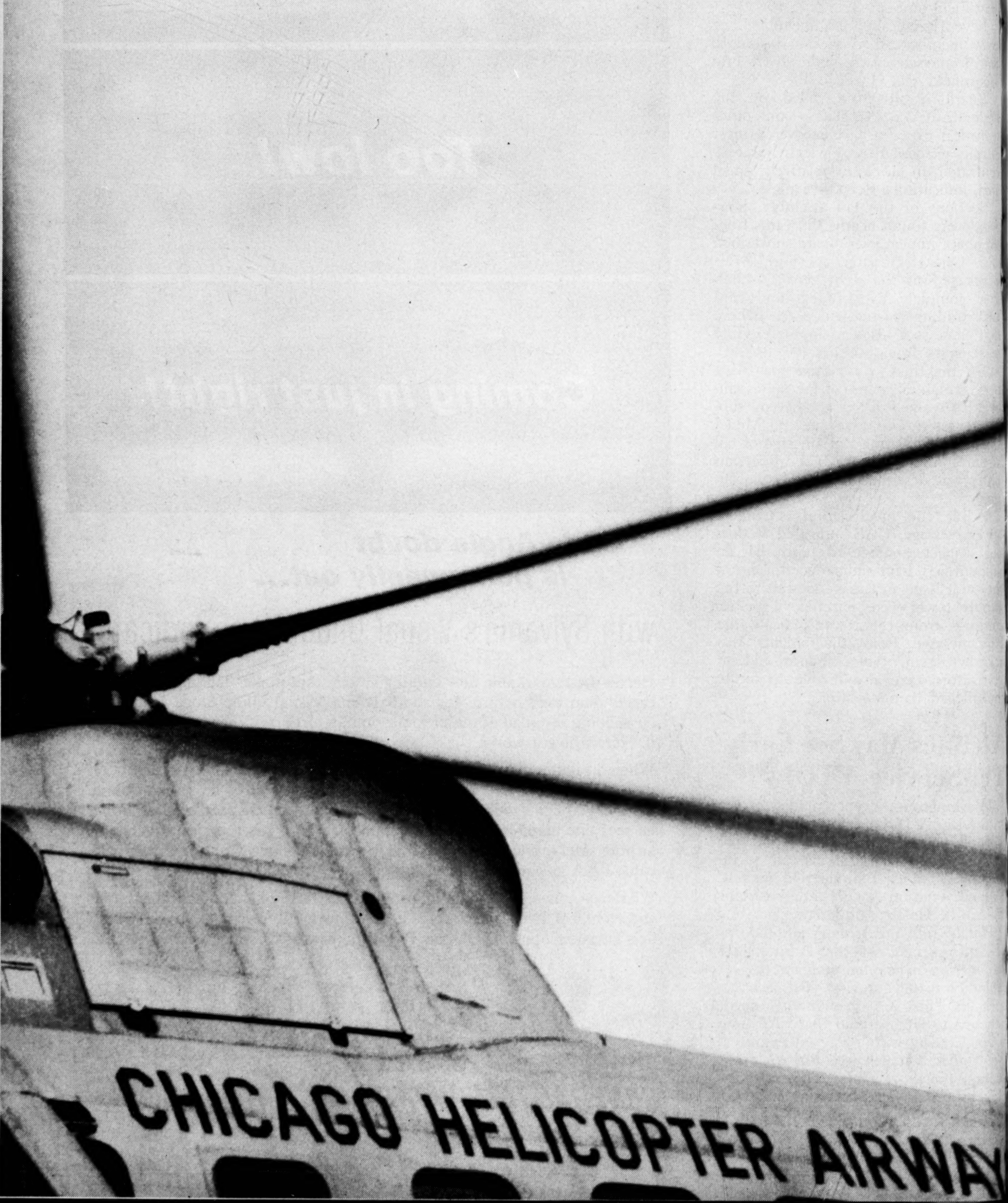

Airline Income and Expenses—Second Quarter, 1961

(IN DOLLARS)

	Passenger Revenue	U. S. Mail	Property	Charter	Federal Subsidy	Total Operating Revenues	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNKS								
American	97,683,559	2,096,805	8,342,127	613,866	....	109,234,022	99,255,393	8,788,744
Braniff	17,880,230	431,265	1,034,962	112,548	....	19,491,375	18,781,662	377,139
Continental	14,641,863	271,056	698,709	47,964	....	15,794,819	14,454,848	782,487
Delta	36,873,132	664,172	1,889,983	99,602	....	39,785,574	35,270,085	3,888,713
Eastern	62,949,412	1,427,476	3,126,691	15,688	....	68,044,664	71,527,163	−4,142,412
National	14,059,956	276,943	937,074	306,129	....	15,744,580	16,502,426	−1,283,592
Northeast	13,126,254	174,200	507,320	31,843	....	13,939,763	14,815,023	−1,534,689
Northwest	18,422,312	529,116	1,199,886	20,483	....	20,410,193	18,638,631	1,512,144
Trans World	65,582,609	1,418,653	4,207,844	571,649	....	72,697,104	73,149,898	−3,163,540
United	105,286,893	3,691,488	7,847,505	371,307	....	118,357,462	109,814,098	7,522,123
Western	12,843,816	259,332	528,607	129,759	....	13,837,626	13,494,428	−127,105
INTERNATIONAL								
American	1,228,761	9,107	211,072	....	....	1,517,788	1,657,961	−130,732
Braniff	2,327,042	107,411	261,662	....	....	2,753,748	3,426,442	−742,717
Caribbean Atlantic	876,031	9,628	46,813	6,446	....	953,783	880,596	75,539
Delta	395,443	1,628	27,769	....	....	426,794	699,289	−389,499
Eastern	7,944,805	204,979	465,913	....	....	8,618,920	8,534,866	45,073
Mackey	497,188	....	19,822	5,745	....	530,878	494,026	34,184
Northwest	7,041,822	1,981,655	989,321	114,033	....	10,653,798	7,831,864	2,592,782
Pan American Combined	88,789,711	7,814,768	12,239,022	5,833,918	....	117,391,311	105,875,186	7,840,776
Alaska	1,151,794	52,506	145,088	....	....	1,349,668	1,422,283	−152,838
Atlantic	43,360,840	3,404,809	4,955,379	2,352,261	....	55,200,932	50,489,503	4,763,485
Latin America	19,914,083	631,736	3,830,971	401,291	....	25,801,963	26,461,467	193,339
Pacific	24,362,994	3,725,717	3,307,564	3,080,267	....	35,033,688	27,481,776	6,208,241
Panagra	3,788,828	185,996	877,302	25,501	....	5,320,578	5,593,648	−371,900
South Pacific	161,319	1,191	6,303	....	....	169,296	359,936	−201,670
Trans Caribbean	1,186,357	....	125,126	314,073	....	1,727,181	1,967,687	−245,344
Trans World	17,596,950	2,080,075	1,971,308	371,672	....	22,688,765	22,673,037	−1,058,384
United	6,087,292	273,393	201,055	....	....	6,144,166	4,660,754	1,869,336
Western	1,004,370	10,484	35,045	....	....	1,058,904	1,162,420	−134,381
LOCAL SERVICE								
Allegheny	3,517,235	49,322	182,963	13,361	1,615,216	5,399,434	5,079,058	347,881
Bonanza	1,370,515	11,999	42,017	1,361	839,687	2,268,613	2,008,932	203,985
Central	931,522	34,677	60,948	3,316	1,119,719	2,161,699	1,980,847	170,472
Frontier	1,765,439	59,294	109,407	4,208	1,726,992	3,693,502	3,513,020	140,484
Lake Central	1,498,273	31,122	80,392	1,728	1,040,848	2,654,081	2,546,077	80,298
Mohawk	3,135,835	48,803	120,568	76,581	1,067,792	4,506,685	3,972,568	414,230
North Central	3,980,843	103,387	205,672	7,216	2,040,124	6,366,768	6,075,508	228,703
Ozark	2,140,694	53,675	133,164	23,650	1,001,785	3,374,281	3,147,593	189,404
Pacific	1,628,222	46,170	47,871	171,674	992,037	2,890,079	2,592,866	225,619
Piedmont	2,310,580	33,605	84,719	50,857	1,164,808	3,676,392	3,305,506	325,469
Southern	1,466,521	53,878	75,588	11,509	1,050,390	2,664,435	2,398,606	244,060
Trans-Texas	1,404,835	40,305	90,527	38,856	993,206	2,580,340	2,553,768	15,246
West Coast	1,675,063	28,997	56,577	6,475	1,275,594	3,054,477	2,681,281	315,037
HAWAIIAN LINES								
Aloha	1,157,005	6,031	19,737	213	84,617	1,348,504	1,345,119	−68,972
Hawaiian	1,629,126	10,973	232,479	3,045	79,779	2,024,381	1,967,451	4,936
CARGO LINES								
Flying Tiger	....	25,323	2,627,255	4,775,808	....	7,528,507	7,190,601	163,957
Seaboard World	....	1,216,712	2,078,125	1,452,743	....	4,778,801	5,791,129	−1,126,162
Slick	....	....	....	2,304,175	....	2,343,546	1,991,705	468,411
HELICOPTER LINES								
Chicago Helicopter	387,017	9,276	2,294	350	389,651	788,662	842,221	−29,366
Los Angeles Airways	71,785	41,811	36,871	....	266,389	417,809	410,591	10,399
New York Airways	293,187	12,729	18,839	12,655	574,175	921,600	1,029,923	−114,416
ALASKA LINES								
Alaska Airlines	642,929	159,494	152,981	753,974	475,952	2,261,501	2,137,006	109,125
Alaska Coastal	277,488	28,200	37,478	13,891	176,697	546,127	534,451	5,414
Cordova	62,230	28,434	47,623	87,645	103,534	331,564	353,384	−24,041
Ellis	192,251	13,805	24,044	5,883	98,634	345,856	333,122	8,764
Kodiak	51,906	2,526	7,794	23,939	9,483	96,060	95,210	−568
Northern Consolidated	344,389	224,420	156,920	34,863	859,964	1,629,206	898,714	702,925
Pacific Northern	2,113,272	255,209	412,893	500	415,308	3,232,802	2,960,164	261,078
Reeve Aleutian	449,173	129,452	134,404	109,423	....	837,741	587,986	253,447
Western Alaska	26,549	5,362	3,187	17,708	16,914	70,132	70,105	−1,901
Wien Alaska	327,314	212,025	132,353	157,596	1,308,772	2,128,374	1,181,708	926,443
Avalon Air Transport	117,400	4,367	2,352	14,998	....	139,624	181,342	−43,565

Data for Aerovias Sud Americana, Capital and Riddle Airlines were not available.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

Airliners, transports, trainers, bombers, fighters, missil

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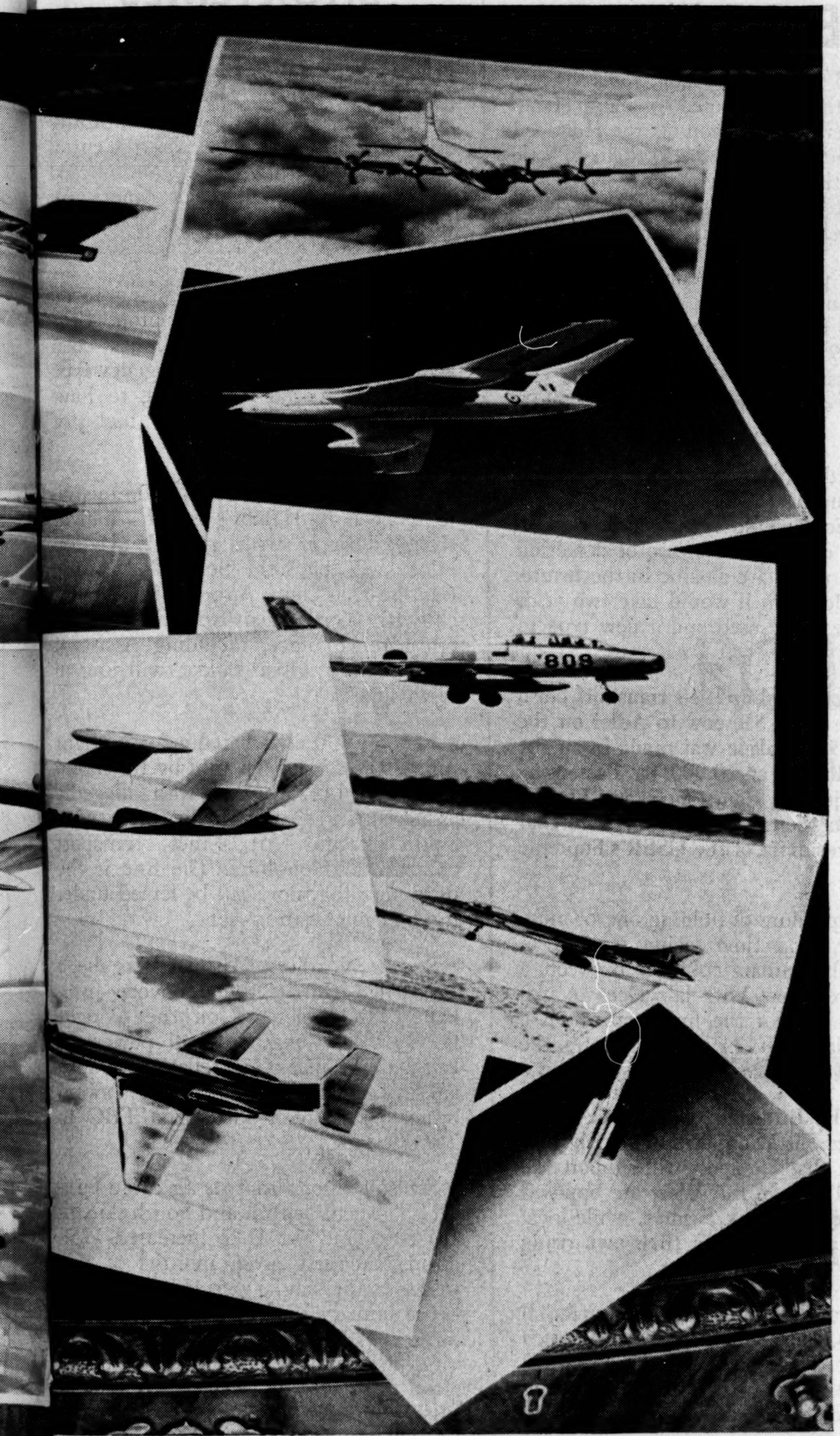

BRISTOL SIDDELEY AERO-ENGINE APPLICATIONS

Olympus turbojet powers . . .
Avro Vulcan Mks 1 & 2 V-bombers
BAC TSR 2 tactical/strike aircraft

Pegasus turbofan powers . . .
Hawker P 1127 VTOL strike aircraft
Fokker/Republic VTOL fighter

Sapphire turbojet powers . . .
Gloster Javelin all-weather fighter
Handley Page Victor Mk 1 V-bomber

Orpheus turbojet powers . . .
Fiat G 91 strike fighter
Fiat G 91 T trainer
Folland Gnat light fighter
Folland Gnat trainer
Fuji TIF 2 trainer
Hindustan HF 24 fighter

Viper turbojet powers . . .
De Havilland DH 125 executive transport
Piaggio/Douglas 808 executive transport
Hunting Jet Provost trainer
Macchi MB 326 trainer
GAF Fairey Jindivik target drone

Proteus turboprop powers . . .
Bristol Britannia airliner
Bristol Britannia military transport

Thor ramjet powers . . .
Bristol/Ferranti Bloodhound guided missile

Gamma rocket engine powers . . .
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AIRLINE OBSERVER

► Striking pilots at Southern Airways and their non-union replacements hired 16 months ago by the airline have both been rejected for membership in the International Brotherhood of Teamsters. Spokesmen for the Hoffa-led union say both groups were advised that the Teamsters feel "there is little that can be done" about the Southern situation. Meanwhile, the Teamsters union is awaiting the results of a poll to determine if International Assn. of Machinists members at Northwest Airlines want to join the Brotherhood.

► **Tourist fares continue to account for most passenger revenue on air service provided by 13 carriers within Europe. Intra-European traffic was 15% higher for the first quarter of this year than for the similar period last year, and tourist accommodations accounted for 91.7% of the 1,970,700 passengers carried. International Air Transport Assn. figures show that while seat capacity increased 15.9%, over-all load factor of the carriers was 50%, slightly higher than for the same period last year.**

► Airlines remain pessimistic over the practicality of many mechanical devices designed to detect explosives in passengers' luggage. One of the most recent, developed by the Atomic Energy Commission, would require the addition of a neutron-absorbing chemical element to dynamite, for ease of detection by a radiation counter. While this approach may have a value in the future, carriers say explosives manufacturers have told them it would take two years or longer for the present supply of dynamite to be used and a new type to appear in any appreciable volume.

► **Russia has revealed some details of another Ilyushin Il-18 transport crash that occurred while the aircraft was en route from Moscow to Adler on the Black Sea. Successful belly landing of the 55-ton plane was made in an oat field after its No. 3 turboprop engine caught fire at 20,000 ft. Passengers were evacuated, apparently without any injuries. Komsomolskaya Pravda, which reported the accident, did not disclose the date but emphasized that crew members were awarded medals by the Presidium of the USSR's Supreme Soviet.**

► Civil Aeronautics Board has adopted the procedure of holding one or more public hearings, at the earliest opportunity, as a time saving method in accident investigations. First hearing on the midair collision between a United DC-8 and a TWA Constellation over New York last Dec. 16 was opened on Jan. 4. The Board has set Sept. 20 for the first hearing on a United DC-8 landing accident at Denver last July 11, and indicates the accelerated hearing process will be expanded for all accident investigations.

► **Railroad subsidy plan recommended by the Interstate Commerce Commission for commuter services has drawn very little opposition so far from the airline industry. Airlines generally doubt that Congress will support the recommendation, particularly since long-haul rails in the West are opposed to it. Subsidies would have a negligible effect on trunk airlines, while local service carriers view the passage as diverting attention from their own rising subsidy bill.**

► Panagra is appealing to "high income" travelers in a new, experimental advertising campaign scheduled to begin this month. Full page ads in such national publications as New Yorker, Field and Stream and Playboy will feature unusual tourist attractions in South America, with copy emphasizing food, fishing, shopping, archaeology, sightseeing and adventure, depending upon the publication.

► **Legal action by Trans World Airlines against Howard Hughes and the Hughes Tool Co., was expected to resume last week with the assignment of Judge Charles M. Metzner of the U. S. District Court, Southern District of New York, to the case. Judge Metzner was expected to set hearings on initial motions in the suit brought by TWA, which alleges interference by Hughes in the airline's equipment financing program.**

► Douglas Aircraft Co. has announced the sale of three Caravelle VI twin-jet transports to Aerolineas Argentina, with options for the purchase of an additional three. First of the Sud Aviation turbojets are scheduled for delivery in December with the balance by early next year.

SHORTLINES

► **Civil Aeronautics Board** has reached a tentative decision favoring American Airlines' request to give up its authority to serve Akron, Ohio. Lake Central Airlines, supporting American, offered to accommodate 74.9% of American's traffic between Akron and Columbus, Cincinnati, Dayton and Cleveland.

► **Fairchild Stratos Corp.**'s improved version of the twin-turboprop F-27 transport, called the F-27F, has been awarded a Federal Aviation Agency type certificate. Aircraft, according to Fairchild, incorporates enough fuel for transcontinental operation.

► **Federal Aviation Agency** Administrator Najeeb E. Halaby's fourth "hangar flying" session with general aviation pilots will be held Sept. 23 at the Bedford-Hanscom Airport in Massachusetts. Top officials from FAA's Eastern regional office, including Assistant Administrator Oscar Bakke, will join in discussions.

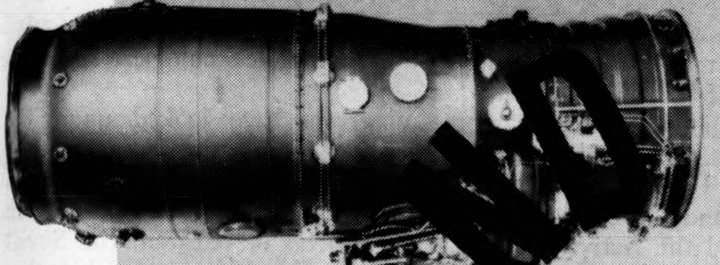
► **First $1,000 civil** penalty for in-flight drunkenness has been paid by Raymond Moore of Los Angeles, who allegedly assaulted and harassed the crew of a South Pacific Air Lines transport en route to Honolulu. The fine is the maximum that now can be levied under the Federal Aviation Act.

► **Pacific Northern Airlines** has been awarded a 100-hr. time between overhaul (TBO) increase on the Wright R3350 BD-1 engines that power its Lockheed Super Constellations. This latest Federal Aviation Agency award brings the airline's authorized TBO to 2,400 hr.

► **Panagra** reports that its air cargo business between Central and South American cities and the U.S. increased 12% during the first seven months of this year over the similar period of last year. From January through July, the airline carried 4,291,000 revenue ton miles of cargo over its Latin American routes to set a company high for the period. Missile tracking equipment was responsible for a major share of the increase.

► **Trans World Airlines** has protested Allegheny Airlines request for authority to fly nonstop between New York and Pittsburgh.

► **William E. Cullinan, Jr.,** has been named manager of Dulles International Airport by Federal Aviation Administrator Najeeb E. Halaby. Now an FAA airport engineer in Portland, Me., Cullinan joined Civil Aeronautics Administration in 1940.



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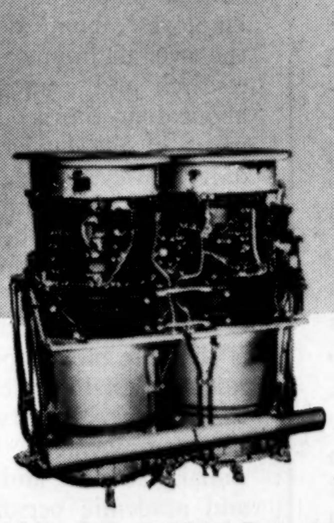

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Soviet Research and Science Reorganized

By Nicholas DeWitt

(Author of the article, Nicholas DeWitt, is research associate, Office of Scientific personnel, National Academy of Sciences-National Research Council, Washington, D. C., and associate, Russian Research Center, Harvard University, Cambridge, Mass. Article originally appeared in the June 23, 1961, issue of Science magazine. Aviation Week *is reprinting the article because of its particular interest to its readers.)*

On 12 April 1961, while the world was caught up in the excitement of the Soviet cosmonaut, *Pravda* published a major decree of the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers of the USSR entitled "Concerning Measures To Improve the Coordination of Research and Development Work in the Country and the Activities of the Academy of Sciences of the USSR." This official decree, first disclosed at a meeting of the Academy of Sciences on 10 April, resolved, finally, the protracted institutional debate which had raged since the mid-1950's concerning the management of the Soviet Union's burgeoning research and development effort, a debate overshadowed by Soviet technological spectaculars.

Some observers have looked upon the Soviet scientific organization as a carefully charted administrative pyramid with a well-developed decision-making mechanism. In some strategic areas of research, the Soviet principle of centralized decision-making has indeed been often and easily translated into the mobilization of human and material resources for the attainment of given objectives. Without separating civilian or military, political or scientific objectives, once a decision was reached, the planning mechanism set in motion the priorities to allocate the human or physical resources from different institutions and from diverse jurisdictions and localities. This was not true, however, of all areas of Soviet research and development. The current decree of the Soviet government and Communist Party forcefully pointed up the problem: "The presence at the Academy of Sciences of the USSR of a large number of specialized research institutions diverts its attention from the long-run basic problems of science, splinters its work force and material resources on many technical problems of a departmental nature, which can be handled successfully in specialized research and development institutes. These shortcomings in the work of the Academy and in other research and development organizations are largely a result of the absence in the country of a single governmental unit which could coordinate research on a national scale. The absence of such a unit in many cases has led to unjustifiable duplications in research and the irrational use of scientific personnel and material resources."[1]

While this problem has existed in the past, it is the recent expansion of the Soviet research establishment which has brought it most clearly to the fore.

Table I provides data[2] on professional higher-education graduates and on research and academic personnel engaged in the Soviet economy in general, and in the research establishment proper. During the last two decades, while the total nonagricultural employment of workers and salaried employes about doubled in the USSR, the over-all number of professionals and of research and academic personnel increased about four times. If we consider employment in the Soviet research establishment only, however, the number of professional graduates of institutions of higher education and of researchers increased at rates substantially higher—five and eight times, respectively.

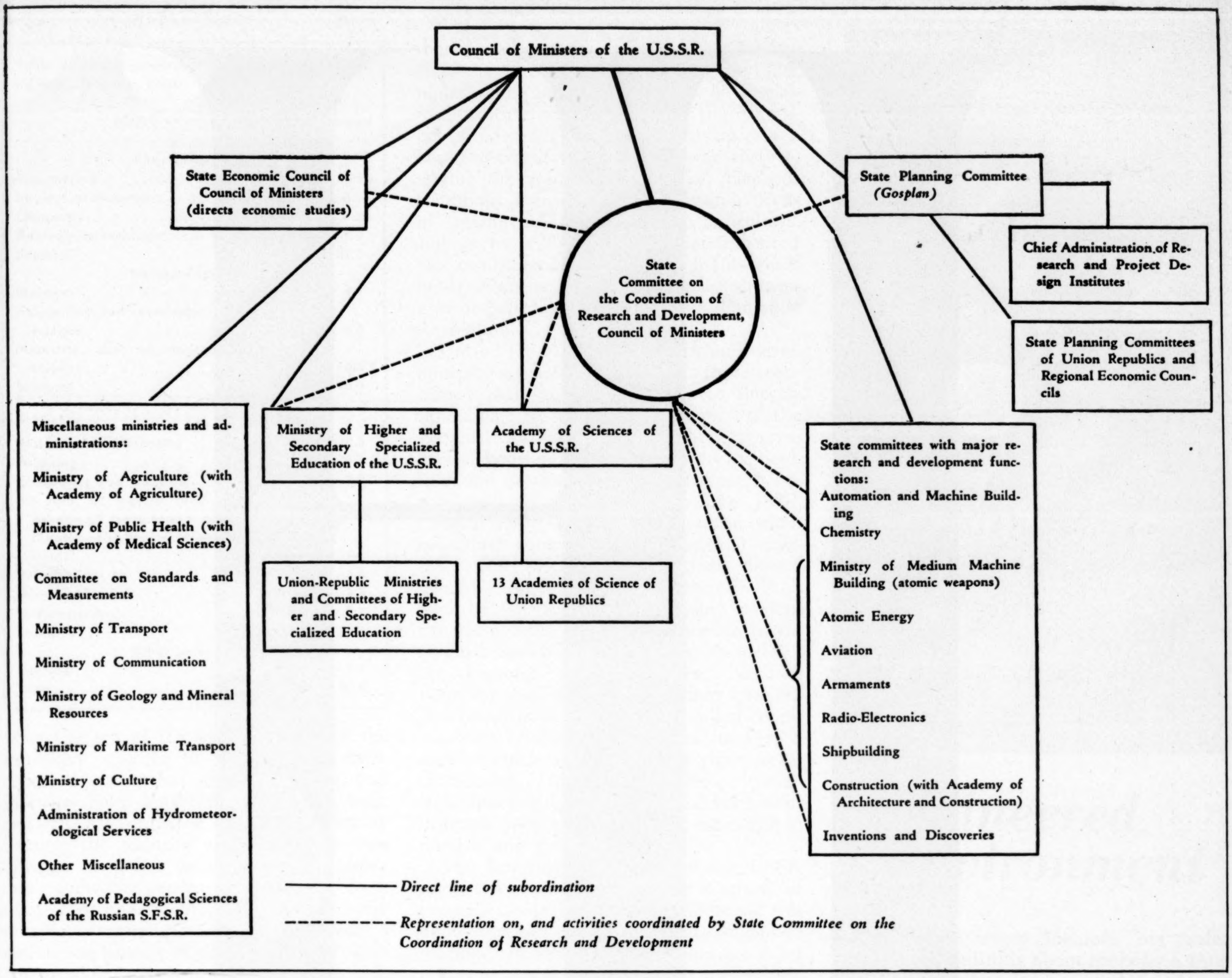
What is particularly important, however, is that the most rapid growth of the Soviet research establishment has taken place in the last 5 years. Between 1956 and 1961 the total employment, the number of professional graduates, and the number of research and academic personnel engaged in Soviet research establishments has about doubled. This enormous quantitative expansion of the Soviet research establishment has consti-

Soviet State Committee Leaders

Science magazine's article lists important leaders in Soviet scientific state committees. Figuring prominently are Mstislav V. Keldysh and Petr V. Dement'ev. The following biographical data were taken directly from Science:

Mstislav V. Keldysh (b. 1911 in Riga), newly elected President of the Academy of Sciences of the USSR (19 May 1961). Applied mathematician, expert in aerodynamics and rocket development. Son of a prominent civil engineer (Major General V. M. Keldysh, of the Kuibyshev Military Engineering Academy and the Academy of Construction and Architectural Sciences of the USSR. Graduate of Moscow State University, 1931. Doctor of physical-mathematical sciences, 1938 (defended his thesis at Steklov Mathematics Institute of the Academy). Professor of mathematics and member of the academic council (governing board) of Moscow State University, 1932 to the present. Joined the Soviet Union's major aircraft development center, TsAGI (Central Aero-Hydrodynamics Research Institute), in 1931, where during the 1930's he directed research on dynamic properties of wings, vibration problems, landing gear and other problems of aircraft design and development. In 1943, was chosen to head the research work in the then-top secret "Research Institute No. 1" of the Ministry of Aircraft Industry, which engaged in Soviet rocket development. Did research and development work at a "research institute" (classified) of the Ministry of the Aircraft Industry in the 1940's and early 1950's. At the time of his election to the Academy's presidency was "director" and "leader of research" (classified) of "several research institutes conducting work in mathematics and mechanics and charged with the solution of major scientific and engineering development problems in the area of special technology", that is, the group of research and development centers for missiles and space vehicles managed mainly by the State Committee on Aviation Engineering, Ministry of Medium Machine Building (weapons development), and Ministry of Defense. Was elected corresponding member of the Academy, 1943; full member, 1946; member of the Presidium, 1953; vice president, 1960. Received two Stalin prizes (1942 and 1946, for work in aerodynamics and aircraft development); received the Lenin prize (sometime after 1956, for undesignated work). Is noted for theoretical work in mathematics (calculus of variations, boundary-value problems), applied mathematics (computers), and aerodynamics (has published no research papers in the latter field since 1939). Has received five Orders of Lenin and three Orders of the Red Banner and was named a Hero of Socialist Labor (presumably on 22 December 1957 at the time of the awards for the development of the first Soviet satellite). Communist Party member since 1949.

Petr V. Dement'ev (b. 1907), Chairman of the State Committee on Aviation Engineering of the Council of Ministers of the USSR, since its establishment in 1957. Aviation engineer; graduate of Zhukovskii Air Engineering (Military) Academy, 1931. In the 1930's was in air force development and procurement work. Deputy Minister of Aircraft Industry, 1953-57 (until its reorganization into the State Committee on Aviation Engineering). Hero of Socialist Labor (highest civilian award). Communist Party member since 1938. Candidate member of the Central Committee of the Communist Party of the Soviet Union since 1952; has been a full member since 1956.


Council of Ministers of the U.S.S.R.
State Economic Council of Council of Ministers (directs economic studies)
State Planning Committee (Gosplan)
Chief Administration of Research and Project Design Institutes
State Committee on the Coordination of Research and Development, Council of Ministers
State Planning Committees of Union Republics and Regional Economic Councils
Miscellaneous ministries and administrations:
Ministry of Agriculture (with Academy of Agriculture)
Ministry of Public Health (with Academy of Medical Sciences)
Committee on Standards and Measurements
Ministry of Transport
Ministry of Communication
Ministry of Geology and Mineral Resources
Ministry of Maritime Transport
Ministry of Culture
Administration of Hydrometeorological Services
Other Miscellaneous
Academy of Pedagogical Sciences of the Russian S.F.S.R.
Ministry of Higher and Secondary Specialized Education of the U.S.S.R.
Union-Republic Ministries and Committees of Higher and Secondary Specialized Education
Academy of Sciences of the U.S.S.R.
13 Academies of Science of Union Republics
State committees with major research and development functions:
Automation and Machine Building
Chemistry
Ministry of Medium Machine Building (atomic weapons)
Atomic Energy
Aviation
Armaments
Radio-Electronics
Shipbuilding
Construction (with Academy of Architecture and Construction)
Inventions and Discoveries
Direct line of subordination
Representation on, and activities coordinated by State Committee on the Coordination of Research and Development

tuted the moving force behind the recent institutional reorganization.

In the last two decades the dominant emphasis of Soviet research activity has been in the area of the natural sciences. This is shown by the data in Table 2, which indicate that in January 1960 an overwhelming 73 percent of all Soviet research and academic personnel were concentrated in the physical and biological sciences. Within these areas, engineering fields alone accounted for over one-third of all research and academic personnel.

Furthermore, the expansion of the Soviet research establishment in the late 1950's was again most rapid in the fields of physical sciences and engineering, as revealed by a comparison of the numerical growth of research and academic personnel by field between 1956 and 1960 (Table 3).

Current Trends

The current trends in training professionals (two-thirds of all graduates of institutions of higher education are in engineering and scientific fields) and research personnel (about three-quarters of them in the natural sciences) indicate that the emphasis in physical sciences and engineering will undoubtedly continue in the 1960's. This quantitative expansion, though achieved at the expense of the humanities and social sciences, has not lowered the quality of scientific or engineering education, which has improved steadily over the years.

The Soviet research establishment today employs a total of 995,000 workers and salaried employes; among them 449,000 are professional graduates, and of these, 188,000 are research personnel. Well over half of the researchers work in the physical sciences or engineering. They are employed in a maze of institutions united under different lines of subordination.

The Soviet scientific research and development effort is presently an extremely complex and highly organized area of human activity, where external institutional machinery determines to a large degree the vitality of scientific progress. In the last few decades in the Soviet Union, as well

Table 1. Total employment of professional graduates and research personnel in Soviet research establishments, in January of the year indicated (figures in parenthesis, index).

Item	Number employed (in thousands)		
	1941	1956	1961
Workers and salaried employes in the national economy (total)	31,500.0 (100)	47,900.0 (155)	62,000.0 (197)
Workers and salaried employes in research and development and science service (total)	361.0 (100)	992.0 (275)	1,732.0 (480)
Workers and salaried employes in research and development only	267.0 (100)	585.0 (220)	1,220.0 (457)
Graduates of professional institutions of higher education employed in the national economy	908.0 (100)	2,340.0 (258)	3,570.0 (394)
Graduates of professional higher-education institutions employed in research and development establishments	91.0 (100)	240.0 (256)	449.0* (494)
Research and academic personnel (total)	98.3 (100)	223.9 (227)	354.2 (361)
Research and academic personnel employed in research and development establishments only	26.4 (100)	96.5 (365)	200.1 (760)
Research Institutes			
Total number	1,821	2,797	3,548*
Number of main research institutes	786	1,210	1,608*

* Data as of January 1960.

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Table 2. Soviet research and academic personnel, by field, January, 1960.

Field	Number	Percent
Physical sciences		
Engineering	106,960	34.5
Physics-mathematics	24,831	8.0
Chemistry	22,724	7.3
Geology-mineralogy	8,990	2.9
Subtotal	163,505	52.7
Biological sciences		
Biology	13,611	4.4
Agriculture and veterinary science	20,210	6.5
Medicine and pharmaceutical science	31,004	10.0
Subtotal	64,825	20.9
Arts, education, humanities, social sciences		
Philology	19,489	6.3
History and philosophy	17,490	5.6
Pedagogy	13,099	4.2
Economics and planning	12,227	3.9
Art and art history (fine arts, painting, sculpture; music; theater, cinema, and related fields)	4,805	1.6
Architecture	1,339	0.4
Geography	3,890	1.3
Jurisprudence	2,112	0.7
Subtotal	74,451	24.0
Other (unspecified)		
Subtotal	7,241	2.4
Total	310,022	100.0

as in the rest of the world, the role of the individual scientist as a vehicle of theoretical discovery has remained strong, and in many fields Soviet theoretical and basic research has displayed excellence precisely because the scientist was left to his own devices. In other fields of research, however, individual endeavors gave way to a mass experimentation approach with two notable characteristics: on the one hand, a continuing process of differentiation of fields and ever-increasing specialization within each field, and, on the other, the emergence of the "problem approach," the interpenetration of distinct fields of science in the study of various natural phenomena and the resulting establishment of interdisciplinary fields. It is the latter which requires increasing attention to basic and theoretical research.

Ever since the golden age of Russian theoretical science, in the second half of the 19th century, there has been an institutional separation of scientific functions. Russian universities and institutes of higher education concerned themselves with professional education primarily and, to some degree, with broad theoretical research. In addition, however, there was a separate network of scientific research establishments which dealt with experimental research, applied sciences, and highly specialized theoretical investigations. In the latter category there were two types of institutions: (i) the Academy of Sciences, dating back to 1724, under whose auspices a number of specialized institutes were set up, and (ii) a number of independent research institutes, which began to emerge at the turn of the century, serving the applied technological demands of various industries or the research needs of specific fields in medicine, agriculture, and so on. The Soviet regime inherited this institutional setup, in which the bonds between universities and research institutes were loosened long before the Communist Revolution.

Until 1929 all Soviet research and development organizations (except those concerned with military areas) were directly subordinate to the Supreme Council of the National Economy, the highest governmental body in charge of industry, agriculture, and other production activities. It coordinated all research activity. In 1929, Pandora's box was opened, however, when individual research and development institutes were placed under separate departmental auspices in order to intensify their work on practical applications and to identify them more closely with service to individual sectors of industry. In the 1930's the Supreme Council of the National Economy itself was broken up into a variety of administrative departments, called "commissariats" (renamed "ministries" in 1945), each of which took charge of a given sector of industry. Under their auspices, specialized, functional research and development institutes were established and expanded in number and size.

The Academy of Sciences of the USSR since 1933 subordinate to the Council of People's Commissars (later Ministers), was under increased pressure to engage in applied research. In response to this pressure it set up many specialized engineering and technological institutes. In 1935, in order to handle these applied-research tasks, a new Division of Engineering Sciences was added to the Academy's other two divisions—those of natural sciences and mathematics and of the humanities. The Academy was again reorganized in 1938, when the number of its divisions reached eight; and in order to broaden the regional base in scientific research, it was empowered to supervise the regional academies of science set up in the various Soviet republics first as branch offices, then as divisions, and, ultimately, as quasi-independent union-republic academies of science.

It should be noted parenthetically that the Russian word *nauka*, though translated as science," has the broader connotation of the German *Wissenschaft* and is not limited to the natural sciences; rather, it embraces all fields of human knowledge, and accord-

Table 3. Research and academic personnel in the USSR., by field, 1956 and 1960.

Field	Jan. 1956 Number (thousands)	Jan. 1956 %	Jan. 1960 Number (thousands)	Jan. 1960 %	Index of growth
Physical science and engineering	103.3	46.0	163.5	52.7	159
Biological science, medicine, agriculture	51.5	23.0	64.8	20.9	121
Arts, humanities, social sciences	62.6	27.9	74.4	24.0	119
Other	6.5	2.9	7.2	2.4	110
Total	223.9	100.0	310.0	100.0	138

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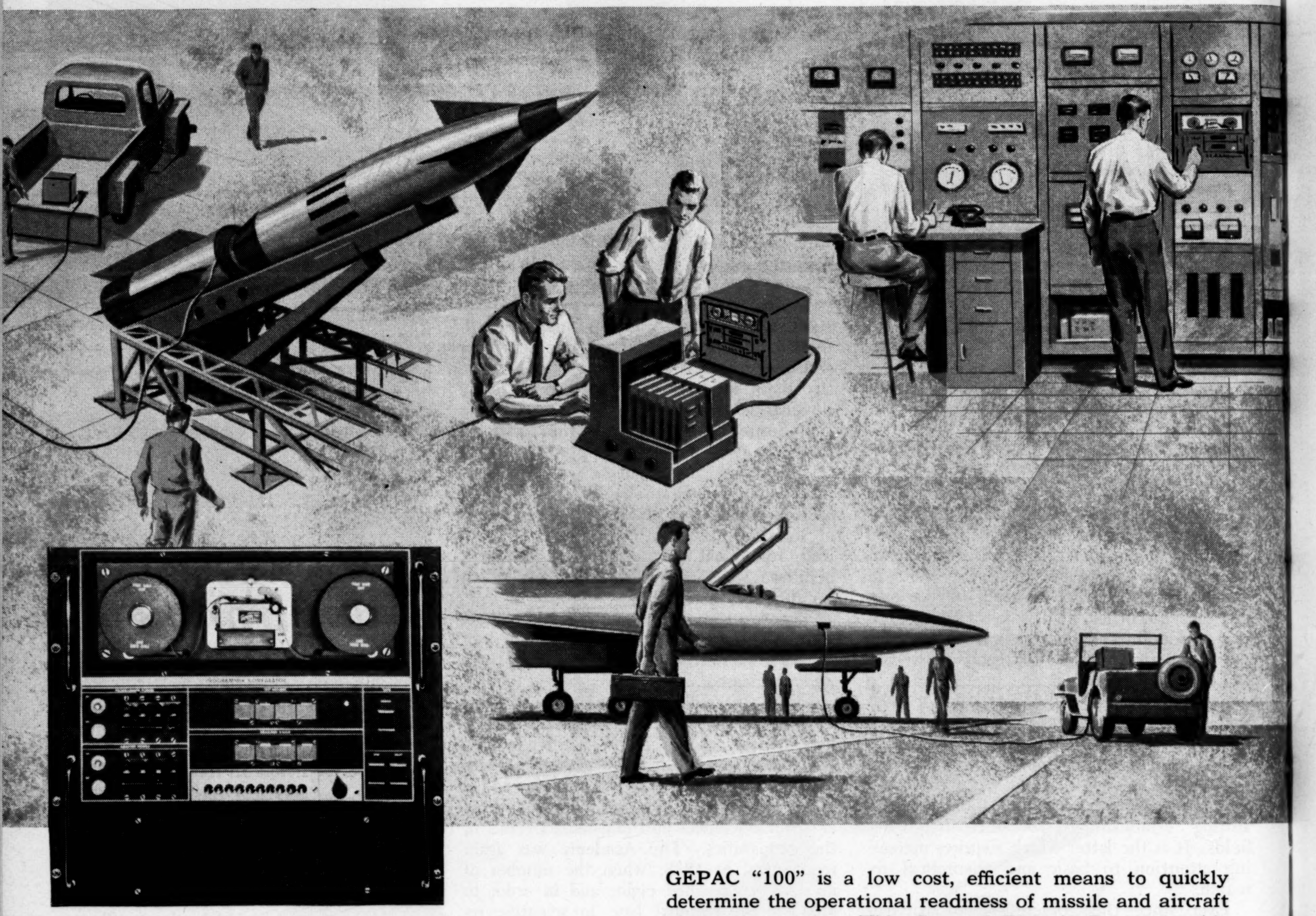

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ingly the Soviet academies of science and various departmental research institutes concern themselves not only with basic and applied natural sciences but with the whole spectrum of knowledge—the humanities, fine arts, social and political disciplines.

But whatever the agglomeration of the fields of knowledge included in the term *nauka*, there are essentially three distinct pyramids in the Soviet research establishment. As of January 1960, these were as follows:

1) Institutions of higher education—universities and institutes (766 institutions in all), employing 138,000 research and academic personnel, of whom about one-third were actively engaged in research. Their research was coordinated by the Scientific-Engineering Council, established in 1956, within the Ministry of Higher and Secondary Specialized Education.

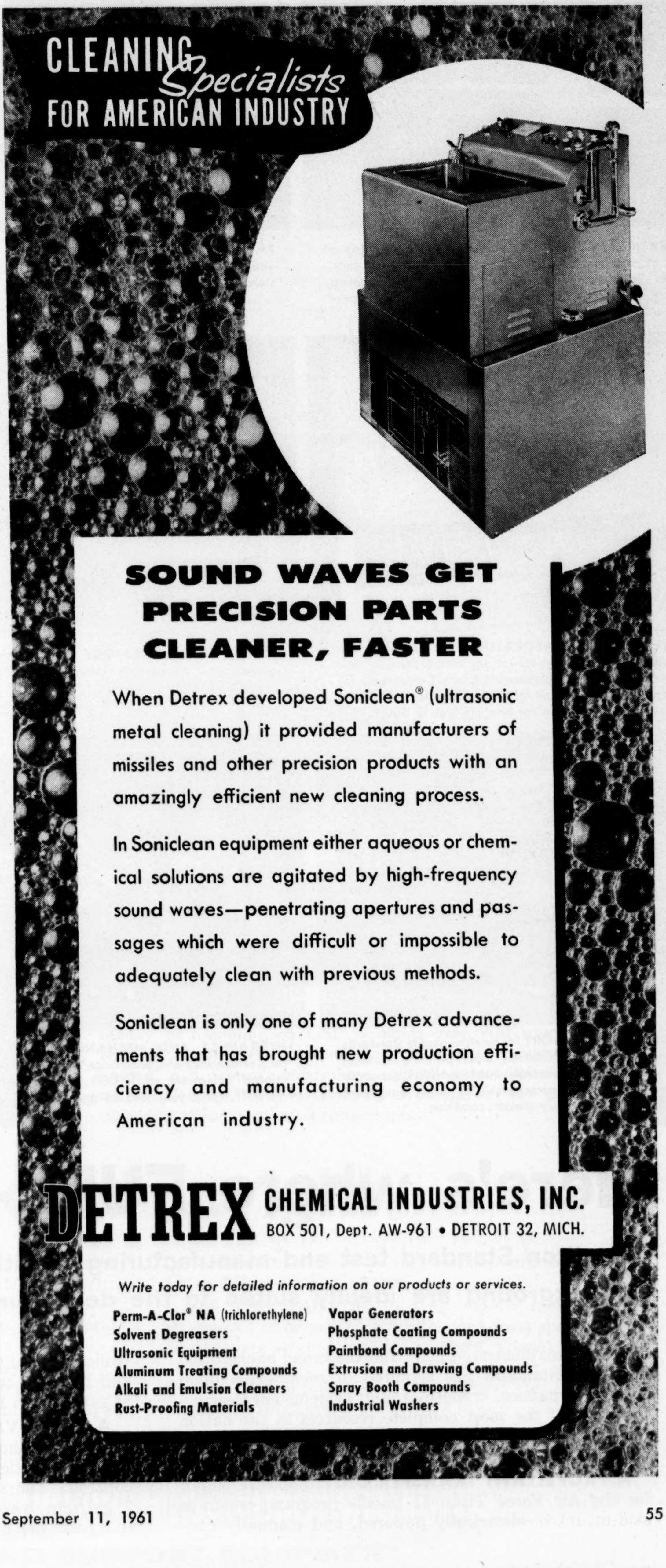
2) The Academy of Sciences of the USSR and the 13 union-republic academies of science (603 institutions), employing 39,317 research workers.[8] Their research was directed by the Presidium of the Academy of Sciences of the USSR, which had a special Council for the Coordination of Research Work of the union-republic academies of science.

3) Departmental (ministerial) research and development establishments (1,005 institutions), employing 125,413 researchers (of whom 18,830, in 494 research institutes, were under the jurisdiction of 13 functional, specialized academies). No central body for coordinating the research activities of these establishments existed until recently, and "institutional research" mushroomed along functional lines, research institutes being formed by the appropriate commissariat or ministry as the need arose—whether for steam turbines, coal mining, school construction, or space research.

The growth of the Soviet research establishment in the last three decades, and particularly since the mid-1950's, was most intensive in pyramids 2 and 3. Table 4 provides data, as of January 1960, on the number of institutions and of research personnel in the Academy of Sciences of the USSR and its regional units (the 13 union-republic academies of science) and in the 13 functional academies. The remaining research personnel (106,653 in 509 research institutes) were employed in departmental research and development institutes under a variety of auspices—of state committees, ministries, and other administrative bodies.

The debate concerning the Soviet science and research setup originated in July 1955. In February 1956, at the 20th Communist Party Congress, Khrushchev declared: "The separation of research activity of the Academy of Sciences, departmental research institutes and higher educational establishments can no longer be tolerated. This separation and lack of coordination prevent the concentration of research activity on the solution of major scientific and engineering problems, lead to duplication of effort and waste of resources, and retard the introduction of research and engineering achievements into production".[4]

Although similar thoughts had occasionally been expressed by other Soviet leaders, the demand to streamline the organization of Soviet research and development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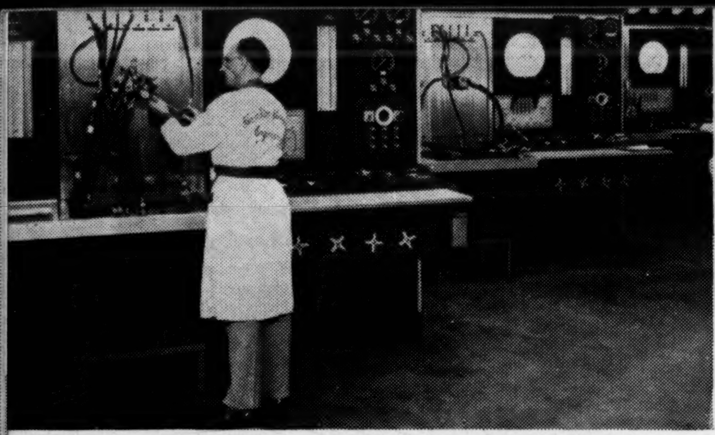

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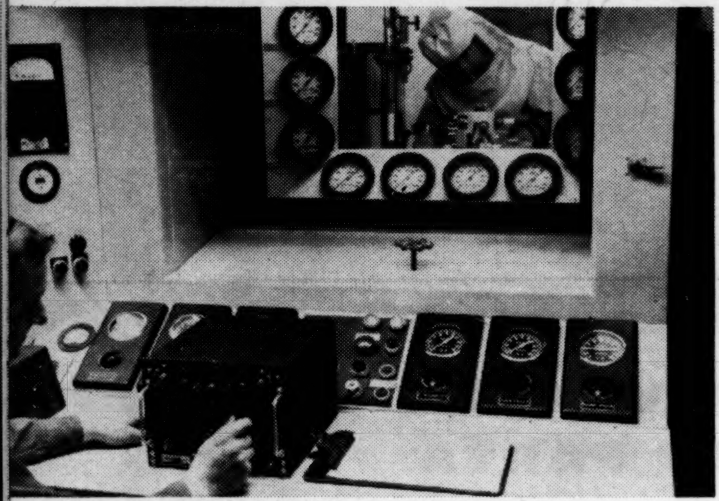

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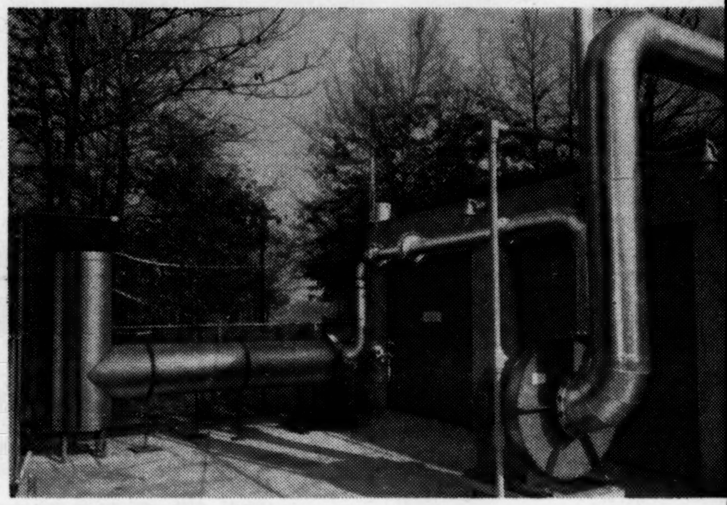

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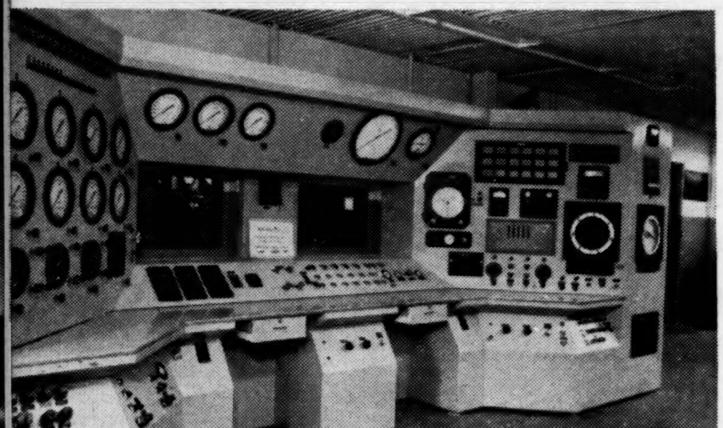

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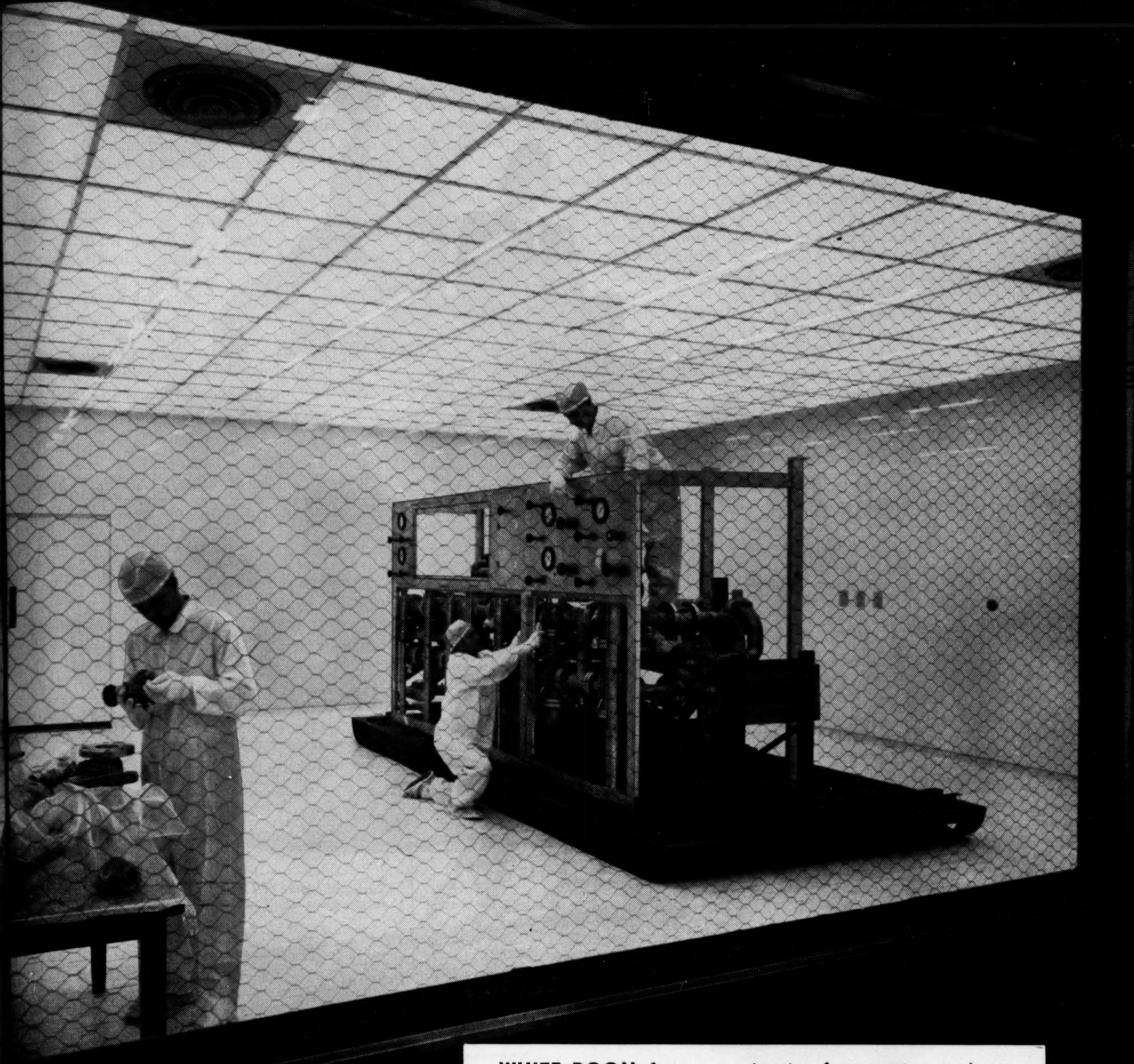

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had never before been presented so forcefully. In 1956 and 1957 a veritable flood of proposals by prominent scientists appeared in the Soviet press, all aimed at streamlining the research organization along the lines of consolidating the fragmented, specialized units and breaking up departmental boundaries.

Meanwhile, beginning in May 1957, the management of Soviet industry was also reorganized, and as a result, a number of departmental research institutes, originally under the auspices of central ministries in charge of particular branches of the Soviet economy, were transferred to regional economic councils or to the newly formed state committees. Among these, the most important was the State Planning Committee, the *Gosplan*, and to it was delegated supervision of the major industrial research and development institutes. By 1958, 323 industrial research institutes, employing 19,000 researchers, were subordinated to the *Gosplan*, which formed a new directorate, the Chief Administration of Research and Project Design Institutes (*Glavnüproekt Gosplana*). This new directorate was to coordinate applied technological research and project-design activity in areas not under the jurisdiction of other state committees. The research and development institutes of other state committees were to carry on both applied and basic research in areas under their jurisdiction,—that is, in radio electronics, aviation engineering, armaments engineering, chemistry, shipbuilding, automation, and machine building. The *Gosplan*, together with the Academy of Sciences of the USSR, was to participate with these committees in delineating their research functions and coordinating their research objectives. Still, there was no central body to coordinate *all* research and development activity.

Separate Committee

In order to speed up the introduction of new technology and scientific discoveries into industry, a separate State Committee on Science and Technology was established (called *Gostekhnika in* 1955, and since May 1957, *Nauchno-Tekhnicheskii Komitet*), which was to conduct research on the uses of new technology, disseminate technological information, and supervise the adaptation of foreign technology.

During this reorganization turmoil, the Academy of Sciences of the USSR came under particularly heavy fire, being pressed not only to intensify its activities on applications for industry but also to direct and coordinate research applications in the other research pyramids. There were three external pressures upon the Academy: political, industrial, and educational.

Political. The Communist leadership insisted upon certain results: an efficient and economical way of conducting research and development activities, a reduction of departmental barriers and unnecessary duplication, and especially a speeding up of the application of research results (particularly in engineering technology) to industry. It wanted the Academy's work geared to these objectives and made "closer to production."

Industrial. The managers of Soviet industry, who were sometimes not eager or were even reluctant to use new technology for fear of disrupting production activity, wanted the Academy's researchers not only to make general scientific investigations and to engage in design and development of products and processes but also to engage in model production and testing and, thereafter, to participate in getting the "bugs" out.

Educational. Although much has been said about the research activities of Soviet universities and other institutes of higher education, for the last three decades the main preoccupation of these institutions has been with academic tasks largely separated from applied research. Universities had indeed carried out some highly theoretical work, but they had only limited access to experimental research facilities. Their applied (contractual) research for industry was small in terms of funds and facilities, though academic personnel frequently participated in the research effort through multiple-job holdings in facilities outside higher education. The educational reforms introduced in 1958 demanded the expansion of research work in higher educational institutions proper, and universities and institutes turned their attention toward the possibility of merging with or absorbing some of the separate research institutes. In order to strengthen instruction in practical applications and to increase research activity, demands were made that a number of the research institutes of the academies should be transferred to higher education auspices.

These three external pressures, however, were counteracted by one fundamental internal force. The scientists engaged in fundamental and theoretical research and the leaders in numerous research institutions of the Academy not concerned directly with applications desired greater emphasis on basic research. They urged the separation of activities and the setting up of new research institutes, not along specialized functional lines but as research task forces or problem areas with an interdisciplinary orientation. In effect, the working theoretical scientists and the leaders of the Academy wanted to rid it of activities which were not genuinely scientific. Largely in compliance with this view and, indeed, in full recognition of the problem, A. N. Nesmeianov, then Academy president, suggested in 1958 that Soviet science "can no longer rely upon foreign basic science . . . what we need now first of all is to develop the fundamental sciences. . . . We need to take decisive measures for the speediest and most widespread development of basic science."[5] He then proposed a sharp reorganization of scientific inquiry, with the Academy dealing only in basic research; applied research in technical and engineering fields was to be carried on by industrial institutes. The radical nature of Nesmeianov's proposals—that is, the separation of basic and applied research activities—was a blow at a cardinal assumption of Soviet dogma, that the "unity of theory and practice" is fundamental to dialectical materialism and that the separation of applied and theoretical objectives in research is inadmissible.

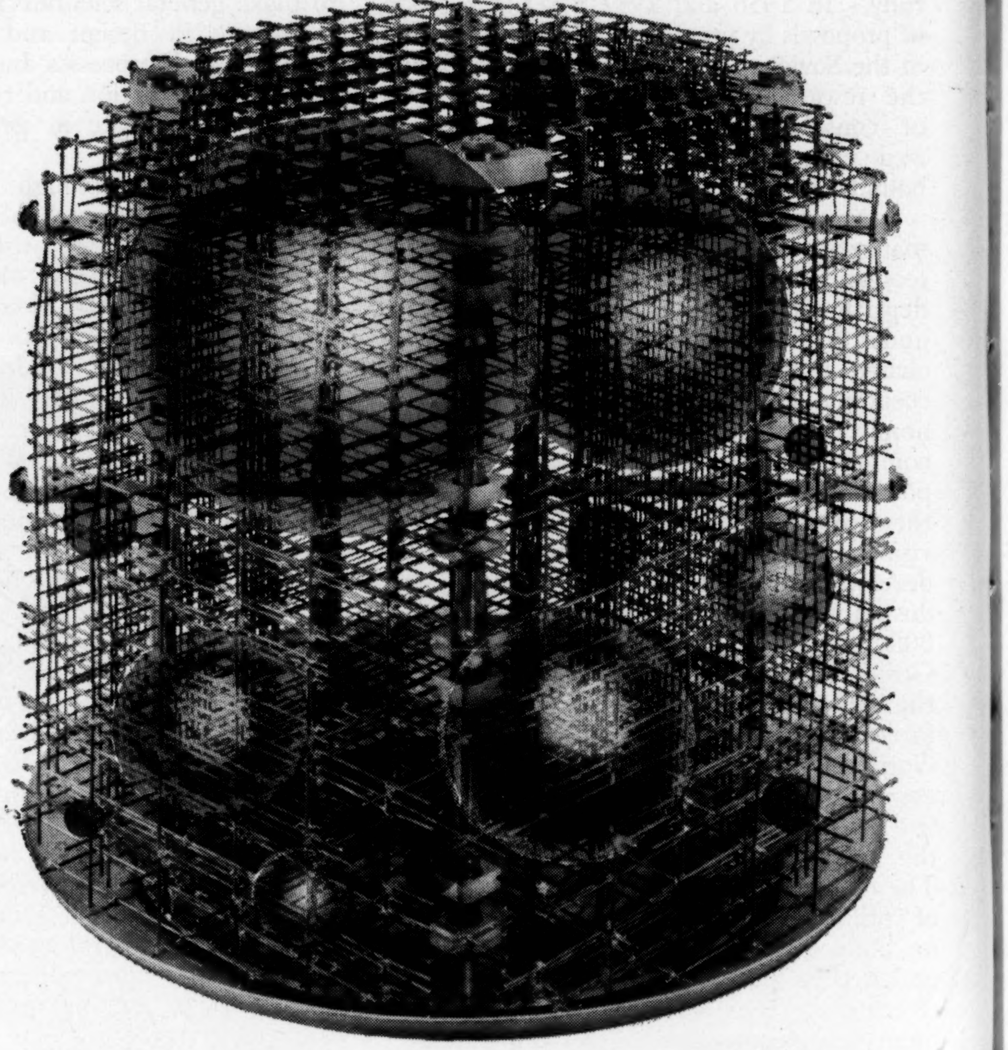
In the summer of 1959 Khrushchev rec-

Table 4. Soviet academies of sciences, research institutes and research personnel, January, 1960.

	Year founded	Academicians: full and corresponding members (No.)	Research institutes (No.)	Research personnel (No.)
Academy of Sciences of the USSR	1725	503	238	23,150
Republic Academies*				
Ukrainian S.S.R	1919	208	60	3,274
Belorussian S.S.R.	1928	76	30	1,250
Uzbek S.S.R	1943	60	30	1,838
Kazakh S.S.R.	1945	76	37	1,500
Georgian S.S.R.	1941	70	44	2,084
Azerbaidzhan S.S.R.	1945	39	24	1,612
Lithuanian S.S.R.	1941	35	15	499
Latvian S.S.R.	1946	37	20	819
Kirgiz S.S.R.	1954	26	12	544
Tadzhik S.S.R.	1951	29	27	709
Armenian S.S.R.	1943	59	28	1,074
Turkmen S.S.R.	1951	37	21	466
Estonian S.S.R.	1946	32	17	498
Subtotal, republic academies		784	365	16,167
Academy of Construction and Architecture of the USSR	1956	196	33	2,642
Academy of Construction and Architecture of the Ukrainian S.S.R.	1956	31	26	1,628
Academy of Arts of the USSR	1947	109	4	92
Academy of Medical Sciences of the USSR	1944	216	32	2,678
Academy of Pedagogical Sciences of the R.S.F.S.R.	1944	92	13	577
Academy of Communal Services of the R.S.F.S.R.	1931	.....	4	359
Subtotal, functional academies		644	112	7,976
All-Union Academy of Agricultural Sciences	1929	142	165	4,758
Academies of Agricultural Sciences of				
Ukrainian S.S.R.	1957	45	76	1,744
Belorussian S.S.R.	1957	28	23	833
Uzbek S.S.R.	1957	15	41	1,222
Kazakh S.S.R.	1957	20	51	1,142
Georgian S.S.R.	1957	21	11	564
Azerbaidzhan S.S.R.	1958	6	15	591
Subtotal, agricultural academies		277	382	10,854
Grand total		2,208	1,097	58,147

*** The Moldav branch of the Academy of Science of the USSR, which had eight institutes and 272 researchers in 1960, is scheduled to begin functioning as a republic academy of sciences in 1962.**

Another measure of the competence of Liquidometer in advanced instrumentation



FLUID, FOAM, OR FLOATING GLOBULES...

whatever a liquid's state or attitude, whether still or in agitation, the volume indication is the same with the Liquidometer Matrix Liquid Quantity Gauge. A capacitor type measuring probe — intercellular in construction — is the heart of the system. In addition to actuating an indicator, output can be telemetered, used for control purposes, or fed into computers. Potential applications: measuring liquid oxygen for astronauts; gauging liquids in advanced rocket propulsion systems; all-attitude gauging of aircraft fuels. Technical details in Booklet 694.

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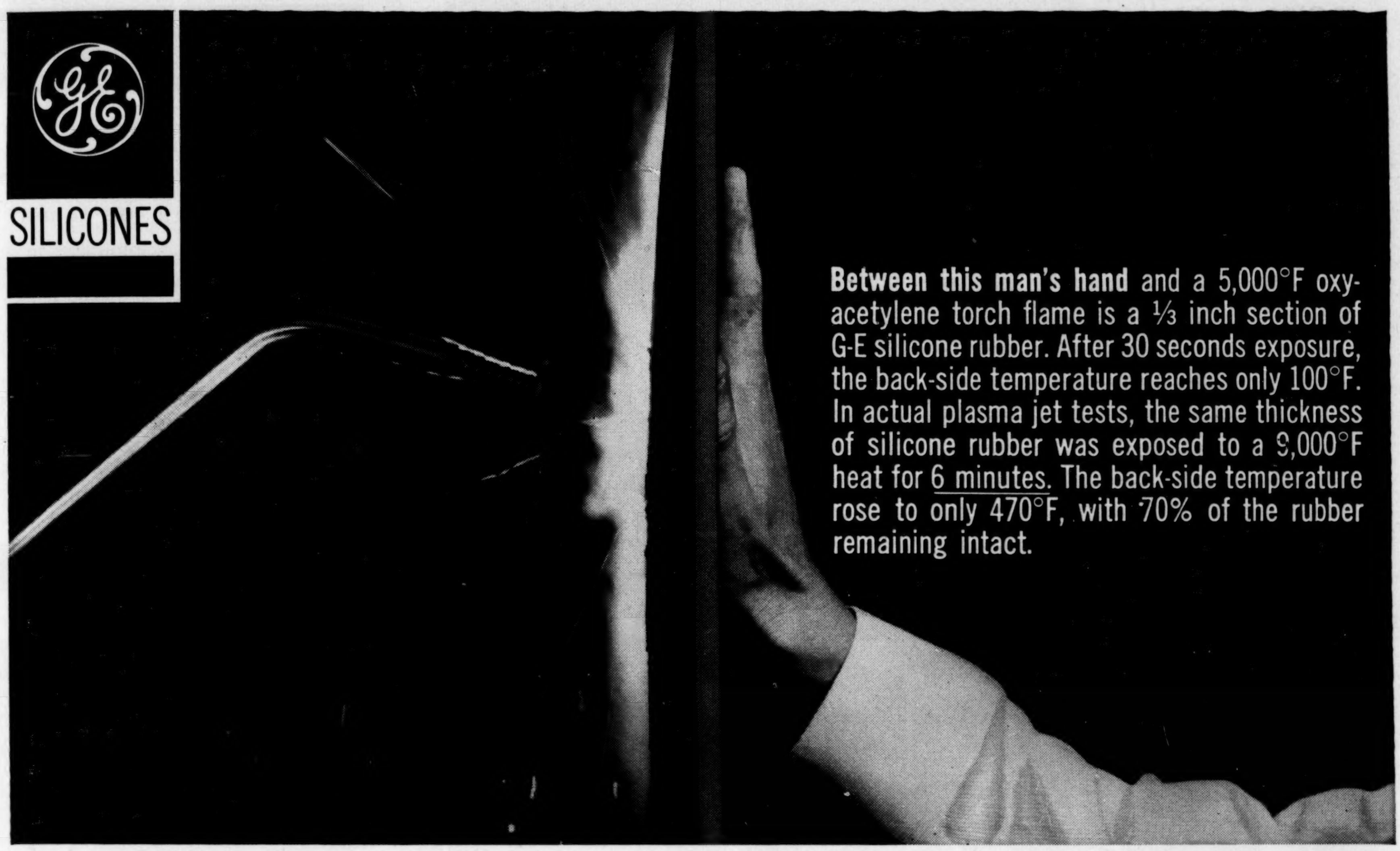


Between this man's hand and a 5,000°F oxy-acetylene torch flame is a ⅓ inch section of G-E silicone rubber. After 30 seconds exposure, the back-side temperature reaches only 100°F. In actual plasma jet tests, the same thickness of silicone rubber was exposed to a 9,000°F heat for 6 minutes. The back-side temperature rose to only 470°F, with 70% of the rubber remaining intact.

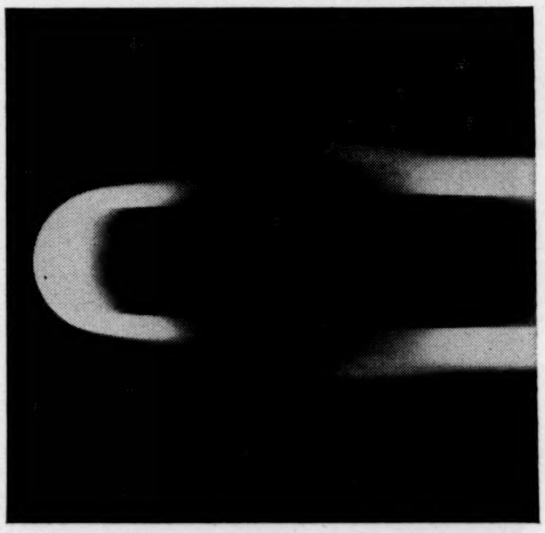
Thermal barrier against 5000°F flame

GENERAL ELECTRIC SILICONE RUBBER

RESULTS OF PLASMA JET TESTS AT 9,000°F

Flight Simulation
Vel.=17,000 ft./sec.
Alt.=250,000 ft.

Exposure time at 9,000°F	Back-side temperature of ⅓ inch section of G-E silicone rubber
30 seconds	100°F
2 minutes	210°F
3 minutes	300°F
4 minutes	375°F
5 minutes	430°F
6 minutes	470°F



The surface of the tested rubber section forms a hard, carbonaceous crust, while the underside remains flexible and undamaged. Preliminary tests showed the effective heat of ablation to be eight times better than presently used plastics, with one-seventh the rate of ablation and one-fourth the weight loss. Here is an excellent ablative covering with low thermal conductivity.

The above chart shows how the high thermal insulation of G-E silicone rubber is maintained during exposure to 9,000°F heat. It is also useful in mechanical and electrical applications at temperatures from —150°F to 600°F, where it remains resilient and flexible. It also maintains its excellent physical and electrical properties over this wide temperature range for extended periods.

Continued high temperature testing goes on at General Electric's Missile and Space Vehicle Department in Philadelphia. Shown above is a typical specimen undergoing plasma jet testing in an electric arc heated supersonic wind tunnel. Continuous testing like this will develop new data on the thermal and ablative uses of G-E silicone rubber.

To learn more about G-E silicone rubber, and its uses as a thermal and ablative material, write: General Electric Company, Silicone Products Dept., Section J961, Waterford, New York.

GENERAL ELECTRIC

new family of electromechanical actuators by Barber-Colman brings important space and weight savings to aircraft and missiles

This new NYLC series of compact Barber-Colman actuators offers you a wide selection of travel and load limit types to help solve critical space and weight problems. The various actuators shown below are individually designed for applications from 25 lb-in. up to 200 lb-in. torque (linear actuators up to 200 lb). The first in this new actuator series, developed for a valve application, resulted in 50% volume and 55% weight reduction over previous types. From its basic design the others were developed to give you a broad choice of configuration, load, speed, and travel characteristics. Other features include externally adjustable internal stops, externally adjustable limit switches, and compact radio noise filtering. For complete details write for bulletins or consult the Barber-Colman engineering sales office nearest you: Baltimore, Boston, Dayton, Fort Worth, Los Angeles, Montreal, New York, Rockford, San Diego, Seattle, Winter Park, Florida.

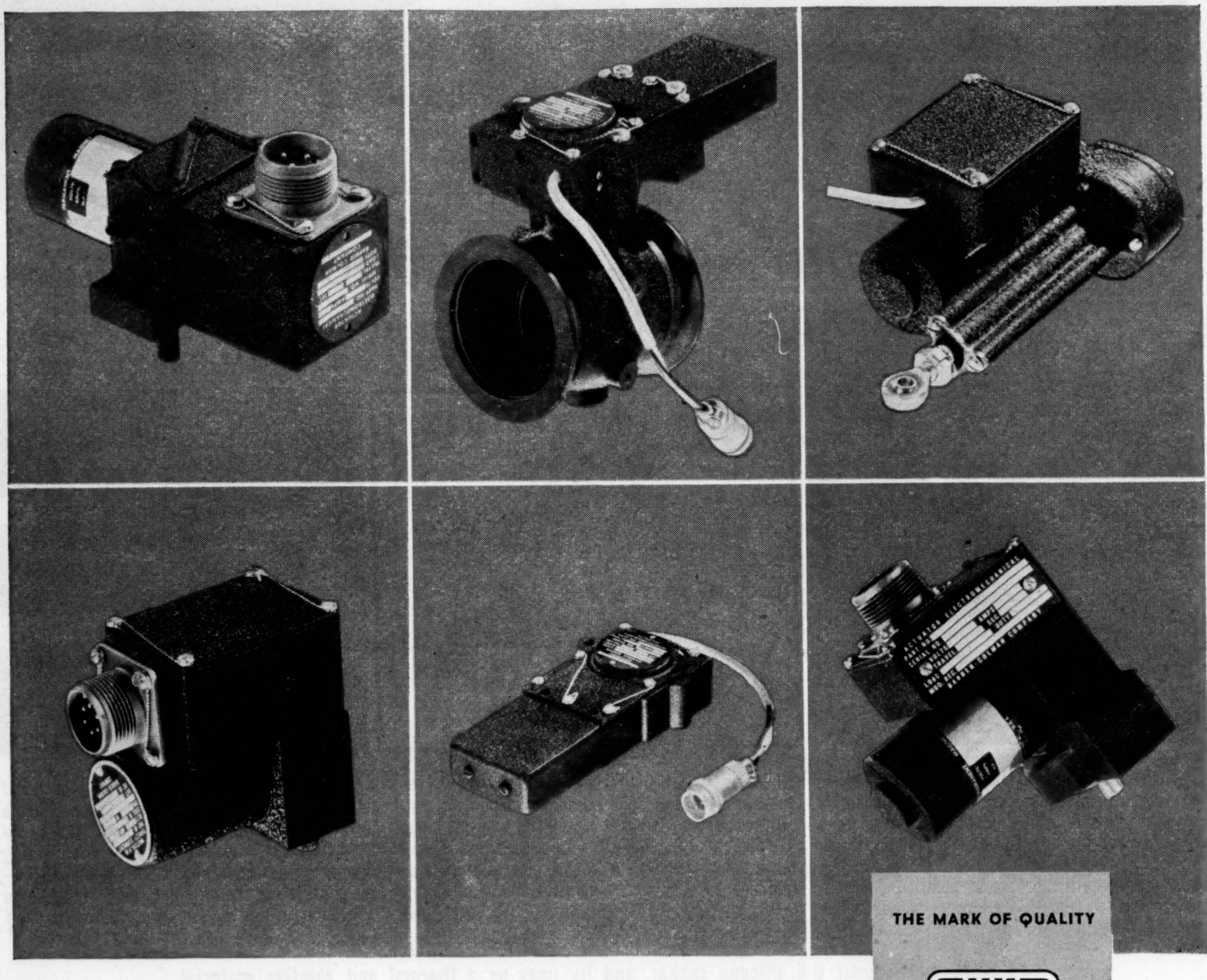
TYPICAL CHARACTERISTICS

Rotary Type

Rated load	up to 200 lb-in
Temp. range	-65° to 250° F
Typical weight	0.75 lb

Linear Type

Rated load	up to 200 lb
Temp. range	-65° F to 250° F
Typical weight	1.25 lb



THE MARK OF QUALITY

BARBER COLMAN

BARBER-COLMAN COMPANY

DEPT. U, 1422 ROCK STREET, ROCKFORD, ILLINOIS

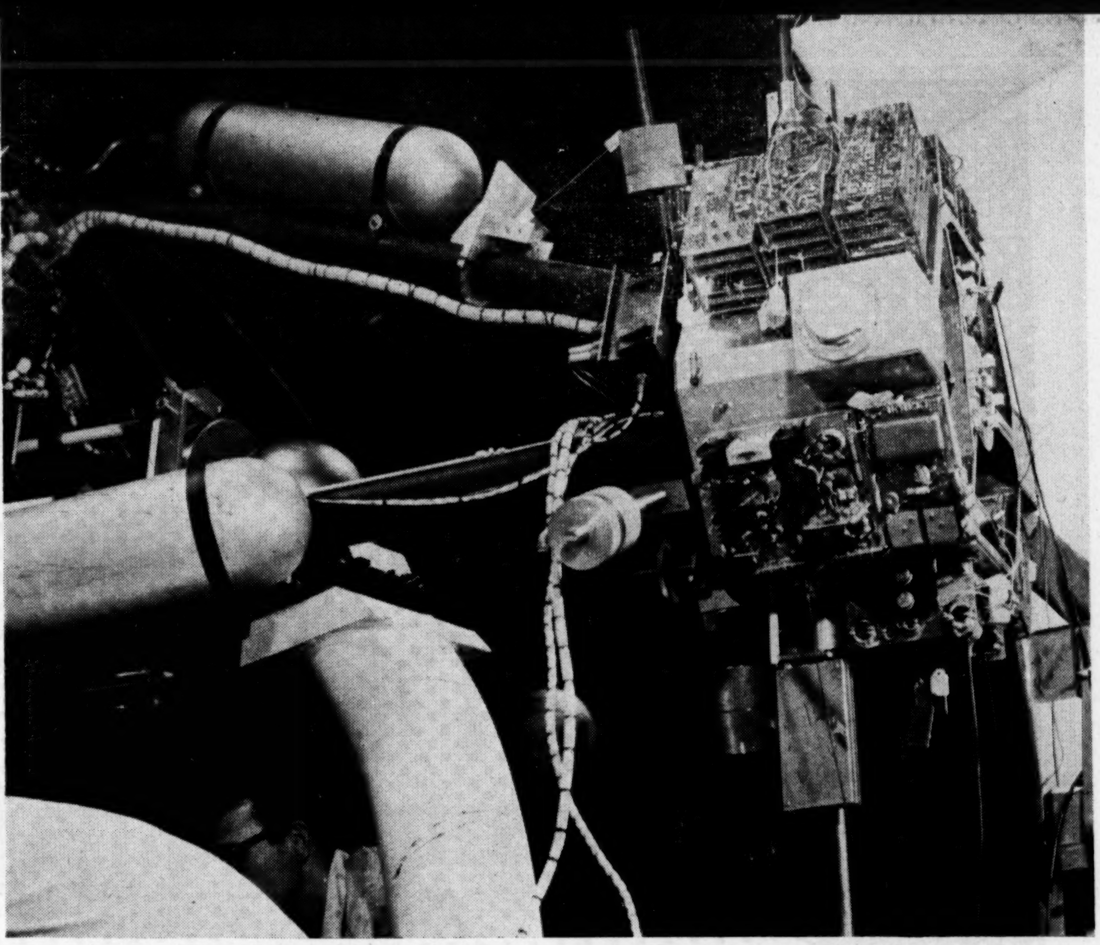
AIRCRAFT AND MISSILE PRODUCTS: AIR VALVES, ELECTROMECHANICAL ACTUATORS, TEMPERATURE CONTROL SYSTEMS, POSITIONING SYSTEMS, SOLENOIDS, TRANSDUCERS AND THERMOSTATS, SPECIAL GROUND TEST EQUIPMENT, POLYFORM ENCLOSURES ognized that a "difficult situation exists in some institutions of the Academy"[6] and suggested that some technical institutes be removed from its jurisdiction since the work of the Academy had become too big and complex for it to continue to have so many technological research functions. The Academy was to continue with experimental research in biology, geology, and some other areas of the natural sciences, but not in such areas of technology as mining, coal, metallurgy, transportation, and other kinds of industrial research.

In keeping with Khrushchev's proposals, Academician N. N. Semenov suggested that the technical sciences division of the Academy be abolished altogether and that its other divisions be consolidated into three major groups: experimental, geological, and social sciences[7]. Research in engineering and the humanities should be carried on elsewhere. Such an arrangement would break down the narrow disciplinary lines of former Academy divisions and institutes. In the newly organized institutes, the departmental assignment of specialized fields to separate research institutes would thus be abolished. In the ensuing debate Semenov's proposals were supported by many leading scientists but were opposed by the applied-technology heirarchy within the Academy's Engineering Sciences Division, who wanted the Academy to retain tasks in applied technology so as to have a link with industry and production. Despite the opposition, Semenov continued to contend that the "responsibility to the state for developing science should rest with the Academy, and for its technical application with the appropriate research institutes elsewhere"[8]. The same note was struck again in 1960 by other theoretical scientists, and Nesmeianov declared anew his belief that the Academy should engage primarily in basic research[9].

The new governmental decree resolves the issue in part at least. It declares: "Institutes of applied specialized profiles, upon the recommendation of the Academy's Presidium, will be transferred to other state committees, ministries and departments"[10] If all the Academy's institutes with a technological profile were thus affected, it would mean the transfer of up to 50 research institutes with an estimated 8,000 researchers. Furthermore, the regional branch offices of the Academy of Sciences of the USSR will be transferred to the jurisdiction of the Council of Ministers of the Russian SFSR and will be operated by regional economic councils.

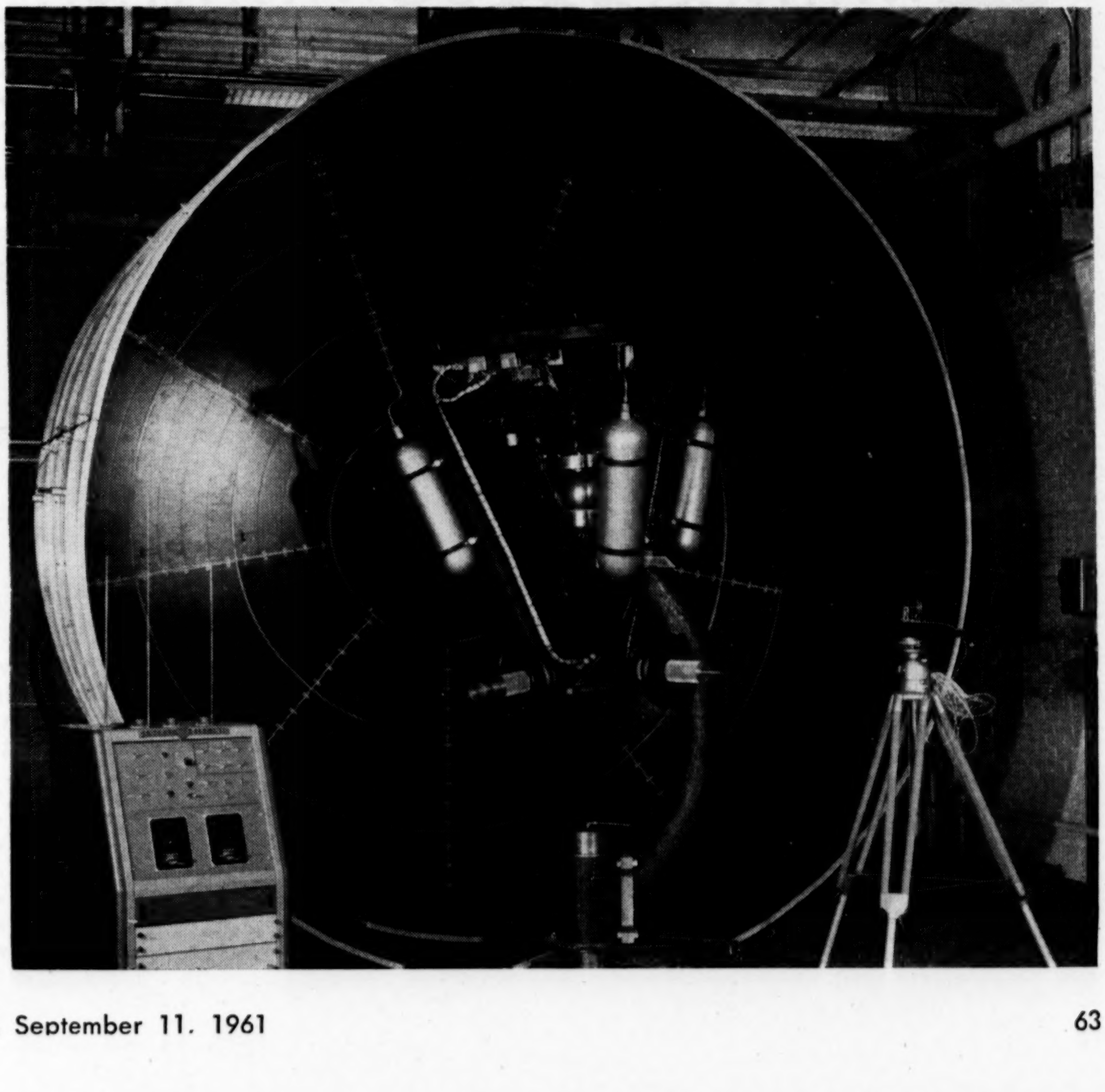
In fact, such a decision has already been adopted at the plenary session of the Presidium of the Academy of Sciences of the USSR, held on 10 April[11]. Accordingly, exclusive of the Academy's affiliates (branch offices)[12], the transfers have so far affected about 30 research institutes, employing between 2,000 and 3,000 researchers. Affected were not only the industrial research institutes of the Academy's Engineering Sciences Division[13] but also institutes under other divisions of the Academy[14], the latter also engaged primarily in applied technical research. Despite these proposed cuts, the Academy will still remain the USSR's largest research unit.

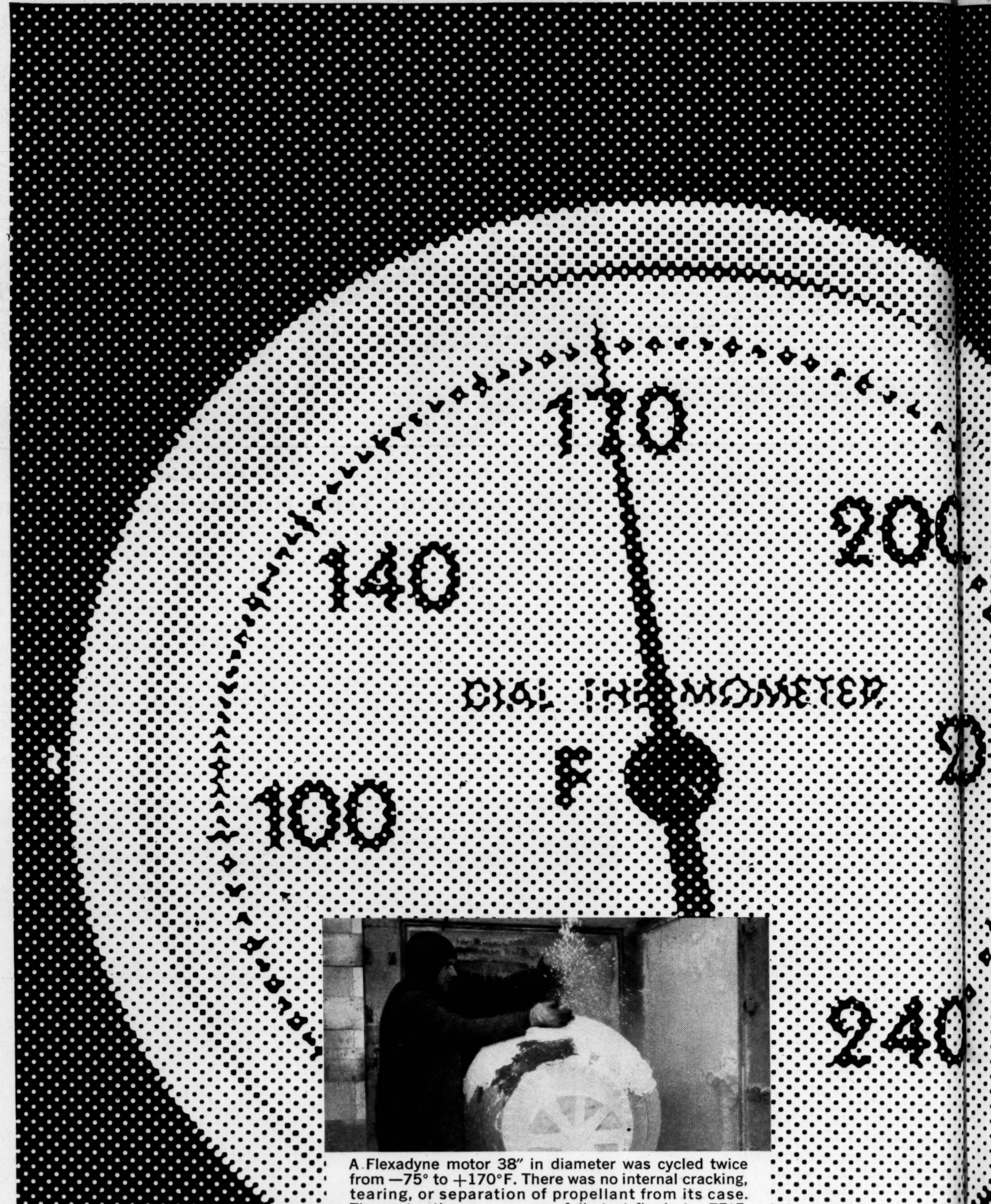
The decree stipulated further that "the work of the Academy should be focused



Earth Simulator Tests Nimbus Control System

Nimbus attitude control system (AW July 10, p. 77) is exercised on a 26 ft. dia. 1,500-lb. earth simulator (below) at General Electric's Missile and Space Vehicle plant, Philadelphia, Pa. System is attached to top of 1:1 scale skeletal structure of Nimbus, shown below hanging inverted on its 10-in. air bearing in a 40-psig. air cushion cup. Modular construction of the simulator allows selective heating of sections to simulate varying land and water temperature gradients. Infrared scanners activate gas jets and reaction wheels to rotate the structure to a vertical position, relative to the simulator, and to maintain attitude within the design objective of one degree along any axis. To preserve the vehicle's freedom of movement (360 deg. in pitch, 160 deg. in yaw and 120 deg. in roll) and delicate air balance, test data is transmitted into an adjacent control room. Preprototype of the control system is shown above, with all electronic assemblies in breadboard configuration. Gas bottles on I-beams are used to induce position or rate errors for the control system to correct. Simulator was designed by GE with assistance from National Aeronautics and Space Administration's Marshall Space Flight Center.

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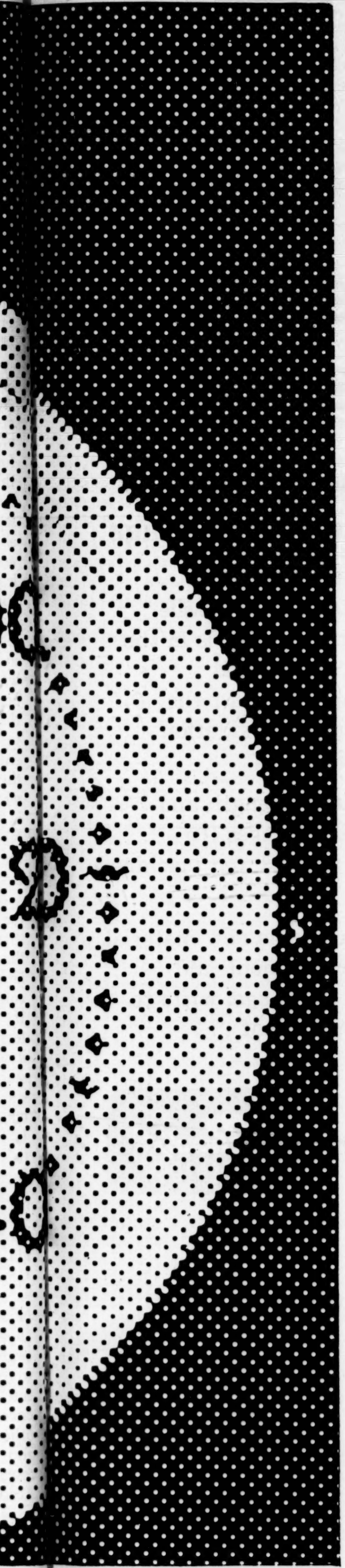
A Flexadyne motor 38″ in diameter was cycled twice from —75° to +170°F. There was no internal cracking, tearing, or separation of propellant from its case. The motor then was successfully test fired at —75°F.



Another Rocketdyne Breakthrough:

Flexadyne— first solid propellants with proven temperature capability

From Rocketdyne, the pioneer in rocket propulsion, comes a family of advanced solid propellants. They are the first case-bonded solid propellants to offer superior performance proven throughout the broad temperature range of –75° to +170°F. They are called Flexadyne.

For multi-million-pound thrust solid propellant boosters, the use of Flexadyne means longer storage life, added performance. Air-launched missiles now can realize full mission flexibility without propellant cracking or bond failure due to extreme environmental temperature changes. No cumbersome "heater blankets" or other temperature conditioning equipment will be required for surface-launched missiles whether deployed in the frigid Arctic or blistering desert. Flexadyne's high resiliency promises maximum compatibility with extremely lightweight plastic rocket cases and resulting improvements in range and payload for any solid propulsion system.

The extended low temperature capabilities of Flexadyne propellants have been proven in numerous large-scale firings at Rocketdyne's Solid Propulsion Operations, McGregor, Texas. These tests culminated in the successful firing of a 38-inch diameter motor containing 3500 pounds of case-bonded propellant. This motor was fired at –75°F. after two-and-a-half complete cycles from –75° to +170°F.

Through research, engineering, and management, Rocketdyne is constantly at work to increase thrust performance and develop new propulsion techniques of both solid and liquid rocket engines. Other forms of propulsion also are under study: hydrogen-fueled engines, nuclear engines, ion engines, plasma jets, magnetohydrodynamic engines. The work at Rocketdyne is the most comprehensive production and development program being conducted on rocket propulsion in the Free World.

Rocketdyne's engineering skill and efficient production methods make it possible to power two missiles today for the cost of one in 1957.

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This unique material combines strength and hardness with weight-saving advantages. In addition, it can be forged, hot worked and machined by conventional methods and equipment.

For information on this remarkable new material and on the Bendix design, development and testing facilities geared to the space age, write to Composite Materials Sales Department . . .

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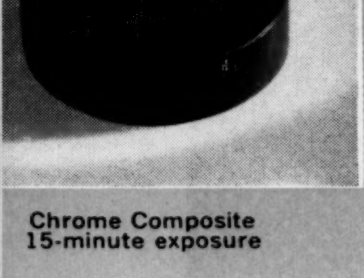
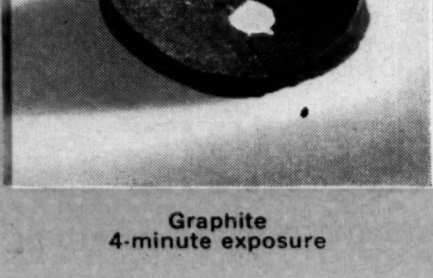
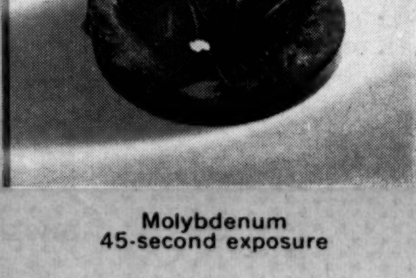
Photos below: material samples exposed to supersonic jet torch at a heat flux of 400 btu/ft²/sec. (approximately 3000°F.)



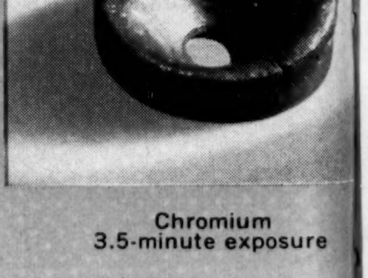
Chrome Composite
15-minute exposure



Graphite
4-minute exposure



Molybdenum
45-second exposure



Chromium
3.5-minute exposure

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primarily on the most important long-run problems of science undergoing rapid development." These functions are precisely the ones which the Academy leadership has been asking for. The Academy will continue to (i) exercise scientific and methodological leadership and conduct research in the area of the natural sciences (physics, mathematics, biology, and sciences of the "universe and earth"—that is, geology, oceanography, astronomy, and so on); (ii) aid the academies of science of the union republics in their research; (iii) coordinate the activities of all the Academy's institutions; (iv) maintain scientific ties with foreign countries; and (v) engage in the training of research personnel.

The Academy's role in regard to the first of these functions was clarified further to include the coordination of work in those areas conducted not only at the Academy but by other institutes as well, especially by institutes of higher education[15]. Although the decree does not make it clear, according to Topchiev, the Academy's role in maintaining scientific ties with foreign countries (function iv) will be to coordinate scientific exchanges with foreign countries, and particularly to expand its activities in the exchange and dissemination of scientific information.

Academy President

Closely associated with the reorganization moves was the sudden replacement of the Academy's president, A. N. Nesmeianov, by academician Mstislav Vsevolodovich Keldysh, who was elected to that post at an extraordinary general meeting of the Academy on 19 May 1961[16].

The official version of the meeting was that former president Nesmeianov had petitioned to be relieved of his duties because of the "expiration" of his second 5-year term. Technically, however, his term would not expire until October 1961, for he had been elected by the general assembly of the Academy on 13 October 1956. Furthermore, the extraordinary plenary session of the Academy was called together on 19 May by its presidium (governing board) to "ratify" the resignation of Nesmeianov, which had already been "accepted," and to elect a new president, whose candidacy was already endorsed by the Academy's Presidium, the "Communist Party group" of the Academy, and by the Academy's eight divisions. Each of these moves indicates clearly that Keldysh, the new president, was coopted prior to the formal election.

The new president, professor and doctor of mathematical sciences, had a meteoric rise in the largely conservative body of the Academy. Elected as a corresponding member in 1943, he became a full member in 1946 (the span between the two ranks is usually at least 10 years). In 1953 he was elected a member of the Academy's ruling body, the Presidium, and became its vice president in February 1960. He did not at any time belong to the internal managerial hierarchy of the Academy; all of his research work in mathematics, aerodynamics, and aircraft and rocket technology was done outside the Academy's research institutes. He thus belonged to that group of academicians (about half of the total of 161 full and 369 corresponding members) who are in the Academy of Sciences of the USSR as honorific members and top-level research coordinators rather than staff scientists in one of its many research institutions. Keldysh has strong ties with the new head of the Committee on Coordination, having worked in research organizations headed by Khrunichev. In addition, he has a long-standing working relationship with other members of the new committee active in the Soviet military research and development effort.

Keldysh's appointment to the presidency was undoubtedly influenced by the fact that in addition to his scientific competence he has had wide organizational experience with the large-scale research and development effort outside the Academy. It is this research-management experience which is needed in the institutional reorganization and streamlining of the Academy's research functions that are presently under way.

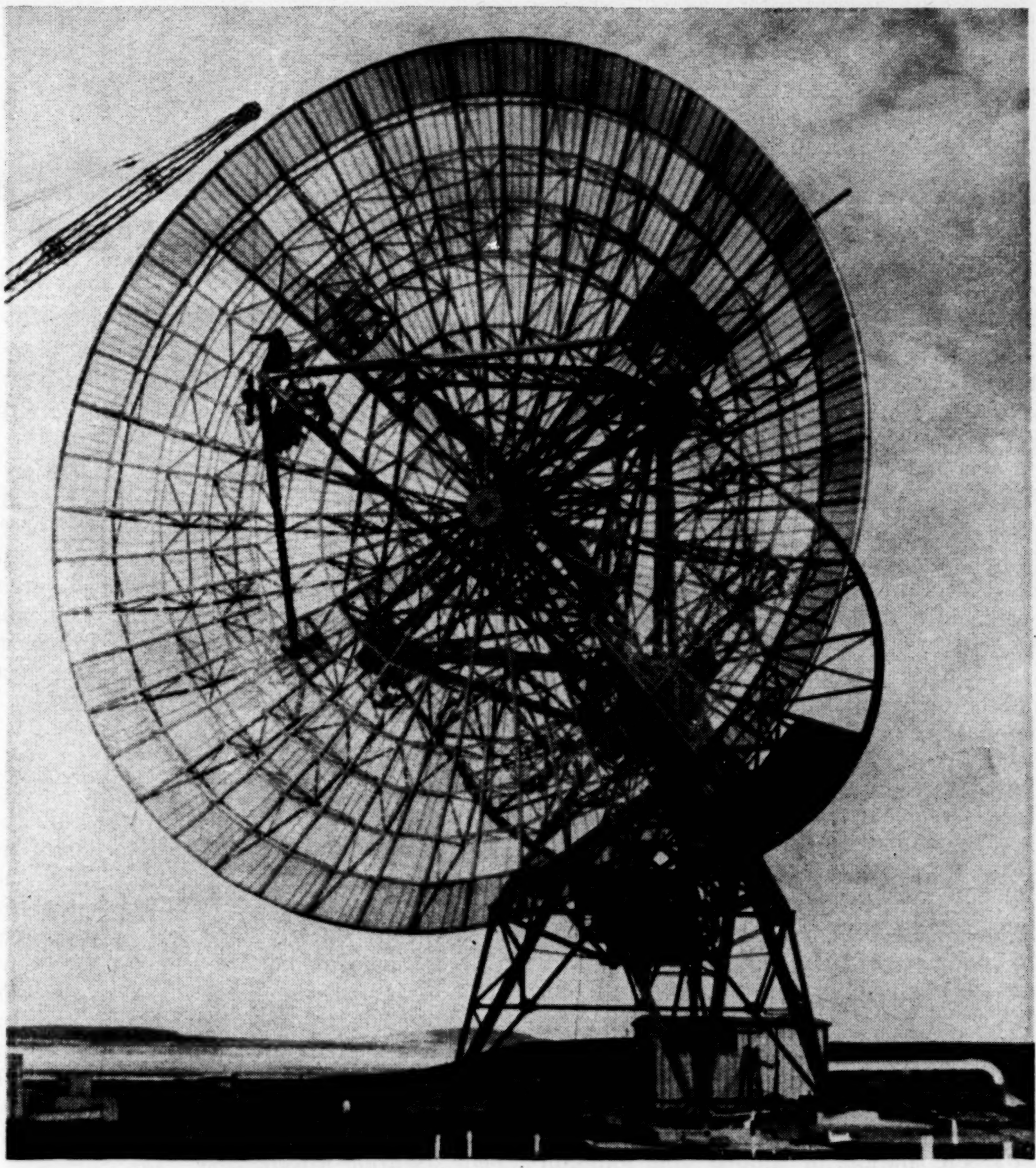
The State Committee on the Coordination of Research and Development will supervise the work of research and development establishments in fulfilling the most important scientific research and engineering objectives in accordance with the directives of the party and the government. It will coordinate work of the Academy of Sciences of the USSR, of the academies of science of the union republics, and of ministries and departments in fulfilling the most important research objectives of an interdepartmental or interdisciplinary nature, and it will guide the direction of research and development work up to the point of its adaptation in the national economy.

R&D Functions

On the recommendation of the Council of Ministers of the USSR, the councils of ministers of the union republics, and ministries and departments, the State Committee on the Coordination of Research and Development, together with the State Economic Council[17] and the State Planning Committee, will develop plans for research and development work in the country at large and for the introduction of scientific and engineering accomplishments in production. The task of the new committee will be to propose these plans for approval to the Council of Ministers of the USSR.

The Committee on the Coordination of Research and Development will have the following specific areas of responsibility.

1) National control over the fulfillment,



Large Tracking Antenna Installed at Woomera

This 85-ft. diameter tracking antenna has been installed at the Woomera Australian missile range by the California Institute of Technology's Jet Propulsion Laboratory for the National Aeronautics and Space Administration. It will be used to track Echo balloon satellites and other space vehicles. The 110-ft. tall, 200-ton antenna is identical with those in operation at the Goldstone, Calif., and Johannesburg, South Africa, stations. The antenna was built by Blaw-Knox Co., Pittsburgh, Pa.

Dummy Atomic Fuel Cores Carried on Atlas

Atlas missile recently carried two simulated atomic fuel cores (AW Aug. 7, p. 35) on a 5,000 mi. flight down the Atlantic Missile Range. The cores, simulated by sodium and potassium tubes, were contained in the pod shown above. At peak altitude, the pod was jettisoned, the tubes released and their ablation recorded by a telemetry pack. Flight was the first of a series to be conducted by the Air Force for the Atomic Energy Commission to confirm that Snap-type nuclear power generators would burn up harmlessly during re-entry.

by all ministries, departments, and organizations, of the most important research objectives, and supervision, on an operational basis, of the introduction of scientific and engineering accomplishments into production.

2) Preparation of proposals for research and development work of greatest national significance, and concern with problems posed by new discoveries and inventions.

3) Preparation of proposals concerning the supplying of research and development organizations with special equipment, installations, and instruments.

4) Study and evaluation of scientific and engineering accomplishments (both domestic and foreign) with a view toward their possible introduction into the national economy.

5) Coordination of all interdepartmental activities of ministries, departments, and research and development organizations in the area of science and technology.

6) Preparation of annual and long-run plans for financing material-technical supply of research and development work, including plans for capital investment for the development of science.

7) Certification of major research and development institutes; such institutes may be opened only with the committee's consent. Particular attention of the committee will be devoted to designating "major" institutes (*golovnyi instituty*) which are interdisciplinary or "problem" research centers.

They have been set up under different departmental auspices in recent years, and it is anticipated that a number of additional such centers will be established in the near future.

Coordination Committee

The former State Committee on Science and Technology has been absorbed by the new State Committee on Coordination. The All-Union Institute of Scientific and Technical Information, which was originally subordinate to this State Committee (though operated jointly with the Academy of Sciences of the USSR), has now been transferred to the new State Committee on Coordination. As in the past, the Institute of Scientific and Technical Information will be the central translating, abstracting, and disseminating organ for domestic and foreign scientific information.

Except for this scientific information institute, the new State Committee on the Coordination of Research and Development will not operate any research institutes directly; rather, its function will be to guide research activities of an interdisciplinary nature, or of great importance, in research units under the jurisdiction of other state committees or departments. However, as in the past, specialized research and development work not of national significance and not of an interdepartmental or interdisciplinary nature will be coordinated by ministries, departments, and regional economic councils.

The new decree, which establishes for the first time in Soviet history a central coordinating agency (see Fig. 1) for research and development for the country at large is to be headed by a Deputy Chairman of the Council of Ministers (Rudnev, replacing Khrunichev who died on 2 June).

It is to be composed of the President of the Academy of Sciences of the USSR (Keldysh); the Minister of Higher and Secondary Specialized Education (Eliutin); the Chairman of the State Committee on Automation and Machine Building (Kostousov); the Chairman of the State Committee on Chemistry (Fedorov); the Chairman of the Committee on Inventions and Discoveries (Garmashev); one of the deputy chairmen of the State Economic Council; and one of the deputy chairmen of the State Planning Committee.

Other Members

There will also be "other members" of the Committee on the Coordination of Research and Development from other state commiteees dealing with research and development work. They were not identified by position in the official decree, but definitely the heads of other governmental departments dealing with research and development will be represented. These are chairmen of the following agencies: state committees on aviation engineering (Dement'ev), armaments engineering (Smirnov), radio-electronics (Kalmykov), electronics (Shokin), shipbuilding (Butoma), and atomic energy (Emel'ianov) and the Minister of Medium Machine Building (atomic, and other, weapon development and production) (Slavskii).

The State Committee on the Coordination of Research and Development will form a permanent scientific council, consisting of leading specialists and scientists of the country, with advisory functions, and when the occasion arises, will call for special boards to study specific problems. Particular significance should be assigned to this latter function. Soviet sources indicate that "although about 80 permanent scientific councils are in existence today . . . about one-half of these are inactive"[15]. The new State Committee on Coordination will thus streamline and activate the work of scientific councils in diverse areas of research, whose activities will now be coordinated by a permanent scientific council[18]. Through these measures, it is hoped, the "leadership role of scientists now working within the Academy of Sciences of the USSR will intensify in the work of the nation's research organization"[19]

The new measures to coordinate research and development are obviously designed to give even more emphasis to the physical sciences and engineering and to complex interdisciplinary problems. The important consideration is that the new chairman of the State Committee on Coordination, Khrunichev, is a person with a strong military research and development background. This is also true of the new president of the Academy, who has not only general background in military research and development but also specific experience in rocket and space technology. In addition, most of the heads of the state committees with research and development functions have similar backgrounds. All are former engineers active in defense fields, now turned industrial managers and political leaders. Upon examining their background, it is hard to resist the view that their past interests have profound implications for the future of Soviet efforts in applied research—that these efforts will be technological in nature, with strong military overtones.

Whatever the outcome may be, however, the intended result of the establishment of the State Committee on Coordination will be the synchronization of the Soviet research and development effort in the distinct institutional pyramids—academies, institutions of higher education, and departmental research institutes. What is even more significant, perhaps, is that responsibility for decisions on scientific research and development has now been lodged at the pinnacle of the Soviet power hierarchy; for the first time in Soviet history the Deputy to the Prime Minister (that is, Khrushchev himself) has been charged with the supervision of these tasks.

In regard to other areas of research, it appears that the earlier setup will continue, as follows.

1) Research on economics will be coordinated by the State Economic Research Council of the Council of Ministers, which was set up in 1959, with the chief role assigned to the economic research outlets of the *Gosplan* and with ever-increasing use of mathematical methods of centralized planning and production programming.

2) As in the past, the Academy of Medical Sciences will supervise and conduct medical research, largely sponsored by the Ministry of Public Health.

3) The Ministry of Agriculture, with its All-Union Academy of Agricultural Sciences and five other regional agricultural academies set up since 1957, will coordinate agricultural research and manage experimental agricultural stations. In the areas of medicine and biology, the Academy of Sciences of the USSR will not be involved, save for basic research in biology.

4) The State Committee on Construction, with its own Academy of Architecture and Construction (organized in 1956), will coordinate construction and architectural research.

5) Political studies (especially "philosophy") will be guided largely by the Academy of Social Sciences of the Central Committee of the Communist Party.

6) In the field of education, the Academy of Pedagogical Sciences of the Russian S.F.S.R. remains the national clearinghouse and conducts major research.

The new centralization of the decision-making mechanism in Soviet research and development will no doubt be manifested in the near future. Freed from burdensome technological tasks, the Academy of Sciences will be able to concentrate more effort on basic research. Many of its institutes are expected to be reorganized. The Soviet authorities hope that the new measures will (i) improve the system of both long-run and current planning of research and the coordination of research and development activity; (ii) further strengthen theoretical research on the most important scientific problems (within the Academy); (iii) allow for closer ties between departmental research institutes and industry; and (iv) allow more rapid introduction of research-and-development results into production technology and the economy.

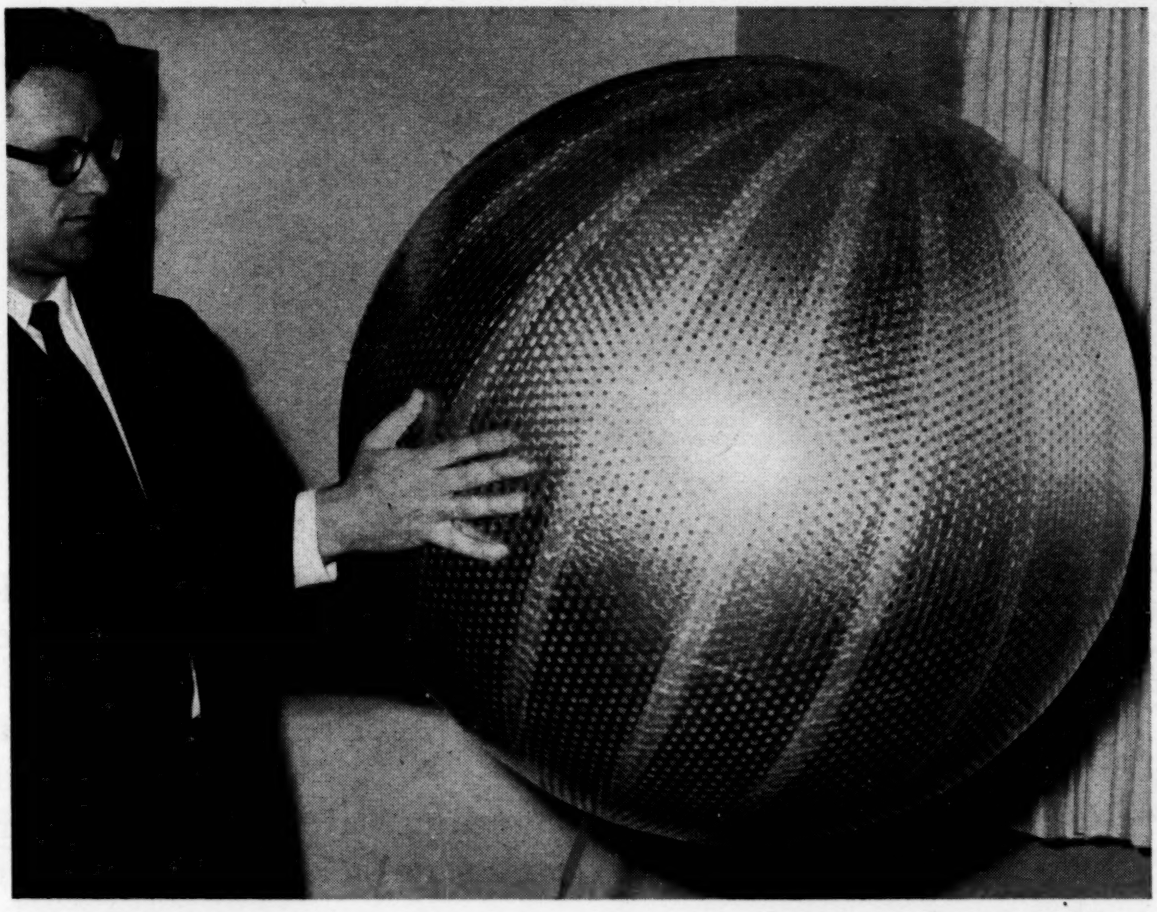
The separation of functions must be clearly recognized. On the operational level the Academy will delegate some of its former functions in applied industrial research to other agencies, and within the Academy, institutes will be reorganized in such a way as to cope with complex interdisciplinary and basic research problems, including a very likely increase in the Academy's role in space exploration. On the consulting and decision-making level the prestige and resources of the Academy will, as in the past, be utilized, though now there will be an intermediate link—the Committee on Coordination—which will in turn exert pressure upon the Academy.

Perhaps these measures are a recognition of a turning point in Soviet technological development: the point of diminishing returns from adaptation of Western technology has been reached, and new and vigorous domestic technological development becomes a necessity. The Soviet political leadership appears to be convinced that the invigoration of technological research activities can be more profitably achieved by separating functions, and by freeing the Academy of Sciences of the USSR to concentrate its attention on basic research and the long-run problems of science.

Reorganization of the Soviet research setup could provide an effective mechanism for channeling scientific manpower and material resources into strategic areas of the physical sciences and engineering toward the achievement of the most ambitious long-run goal of Soviet power—world leadership in science and technology.

References and Notes

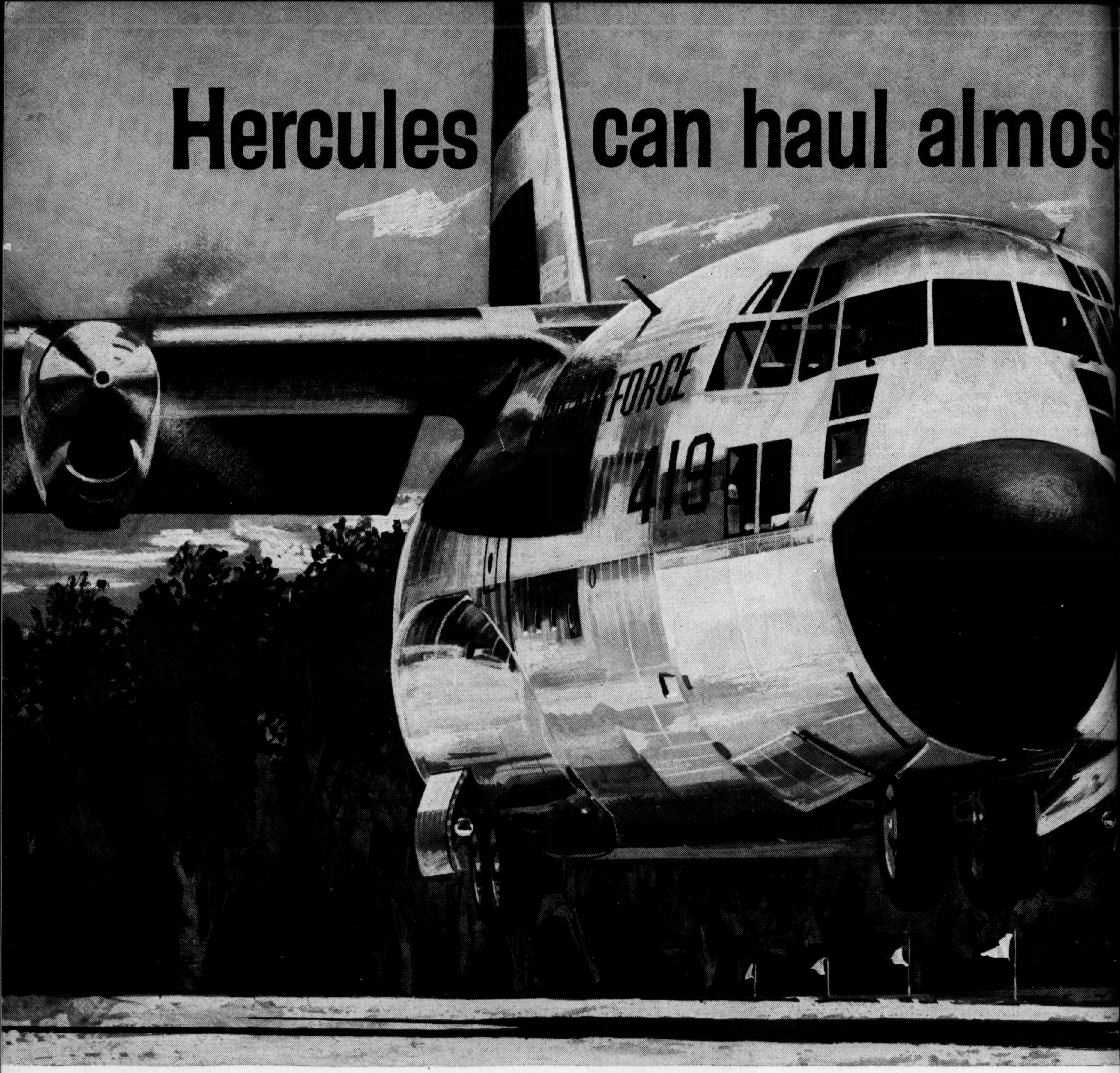
1. *Pravda* (12 Apr. 1961).
2. Some of the statistical information in this article is taken from N. DeWitt, *Education and Professional Employment in the U.S.S.R.* (National Science Foundation, Washington, D. C., in press).
3. A 14th union-republic academy of sciences is scheduled to begin functioning in the Moldavian S.S.R. in 1962; it is presently a branch of the Academy of Sciences of the USSR.
4. *Pravda* (14 Feb. 1956).
5. *Uchitel'skaia gazeta* (20 May 1958).
6. *Pravda* (2 July 1959).
7. *Izvestiia* (9 Aug. 1959). Semenov was a Nobel prize winner in chemistry.
8. *Ibid.* (16 Dec. 1959).
9. *Pravda* (31 Dec. 1960).
10. *Ibid.* (12 Apr. 1961).
11. This information was given me by A. V. Topchiev, vice-president of the Academy of Sciences of the USSR in Washington, D. C., on 26 and 27 April. Dr. Topchiev attended the plenary session just before his trip to the United States. He indicated that no public announcement of this decision has been made as yet, since the Presidium is still considering the possibility of additional transfers of research institutes.
12. There are seven branches: Bashkir, Dagestan, Karelian, Kazan', Kola, Komi, and Ural. An eighth branch—Moldav—is currently being reorganized into a union-republic academy. The seven branches are being transferred to the jurisdiction of the Council of Ministers



Satellite Balloon Weight Cut by Milled Openings

Chemically-milled openings in the aluminum skin of Project Rebound inflatable passive-communication satellites should reduce the weight of the spheres from the present 500 lb. of Echo II to about 350 lb., without loss of rigidity. G. T. Schjeldahl Co., Northfield, Minn., is fabricating the laminated material, comprising two layers of perforated, .2 mil aluminum foil sandwiching a .35 layer of non-perforated polyester film, under a $150,000 National Aeronautics and Space Administration contract. Balloon model of the advanced material is shown above with Richard J. Slater, Schjeldahl engineer.

Hercules can haul almos



Trucks, tractors, troops. Jet engines, jet fuel, jet pilots. Missiles, rockets, guidance systems. Air Force, Army, Navy, Marines, Coast Guard. Whatever, whoever, wherever — Hercules has what it takes to get the job done.

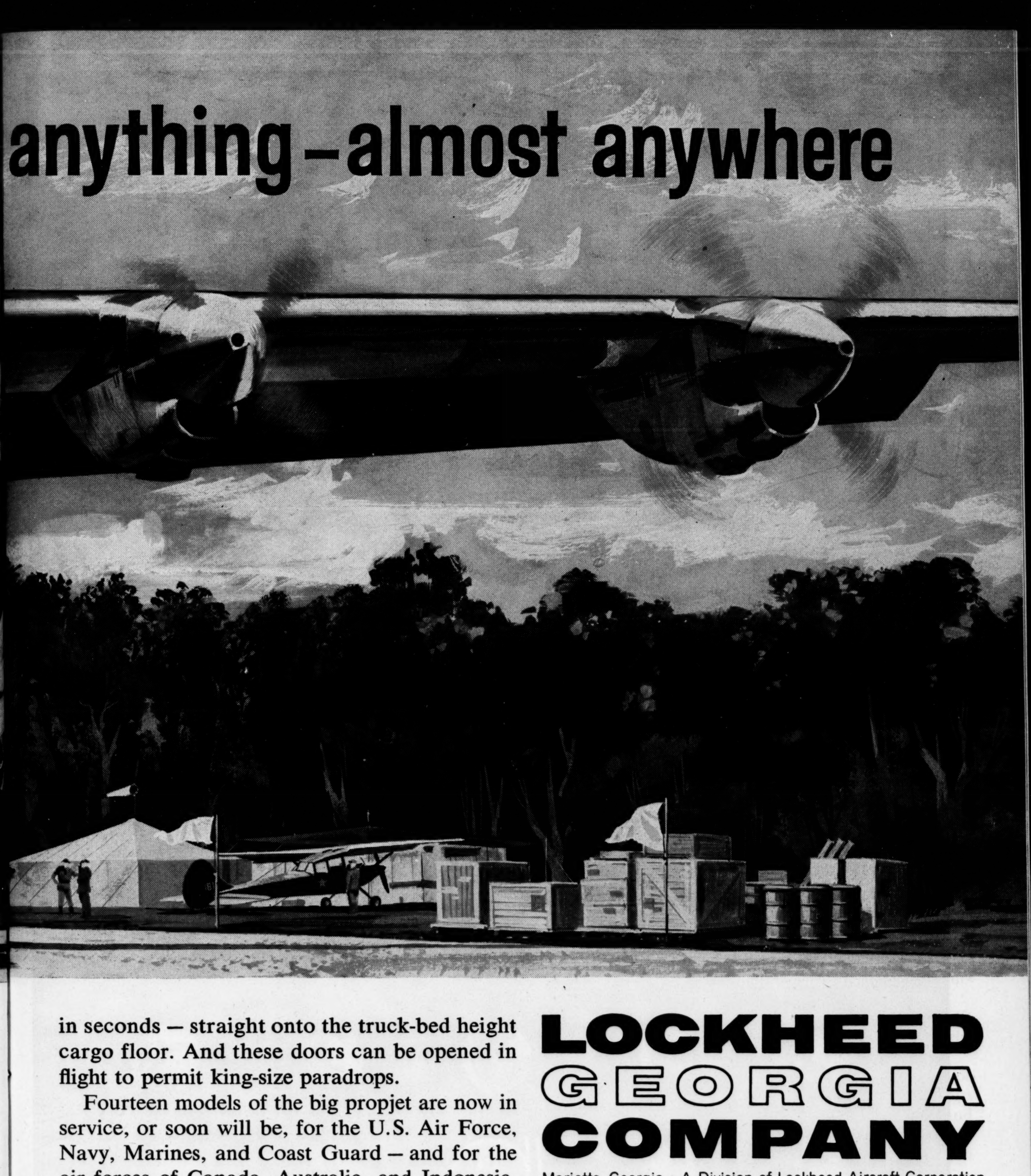
Destination may be a crude landing strip freshly hacked out of the jungle. Or a snow field at the South Pole. Makes no difference. The Lockheed C-130 Hercules can land and take off on just about any reasonably flat, clear spot on the face of the earth — so it can take its vital cargo close to the action without delay.

Hercules is the true airlifter — built for the big work. Its huge rear doors swallow tons of freight

Loads from the rear

Carries 92 troops

Refuels fighters



in seconds – straight onto the truck-bed height cargo floor. And these doors can be opened in flight to permit king-size paradrops.

Fourteen models of the big propjet are now in service, or soon will be, for the U.S. Air Force, Navy, Marines, and Coast Guard – and for the air forces of Canada, Australia, and Indonesia.

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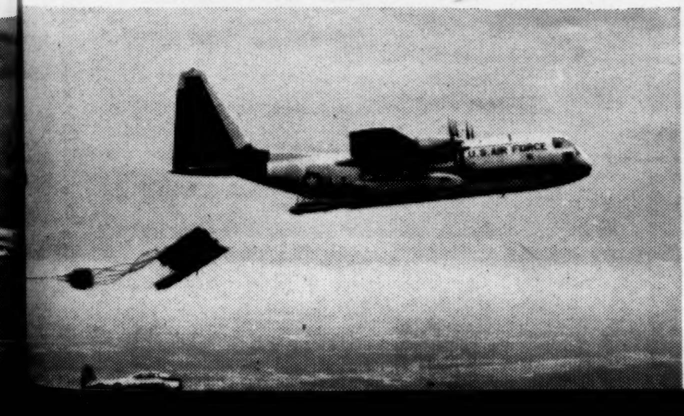
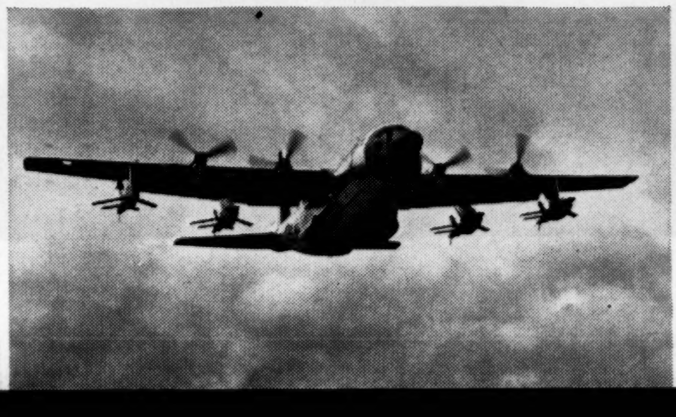
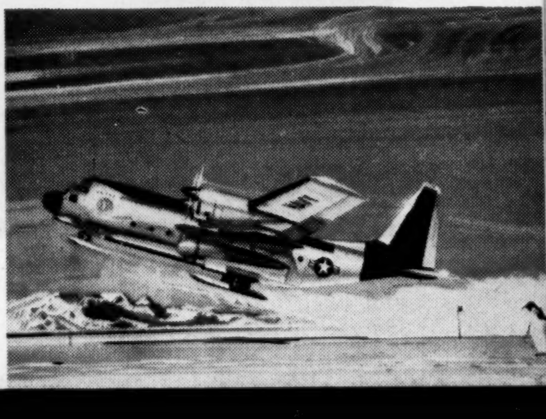
Drops big equipment

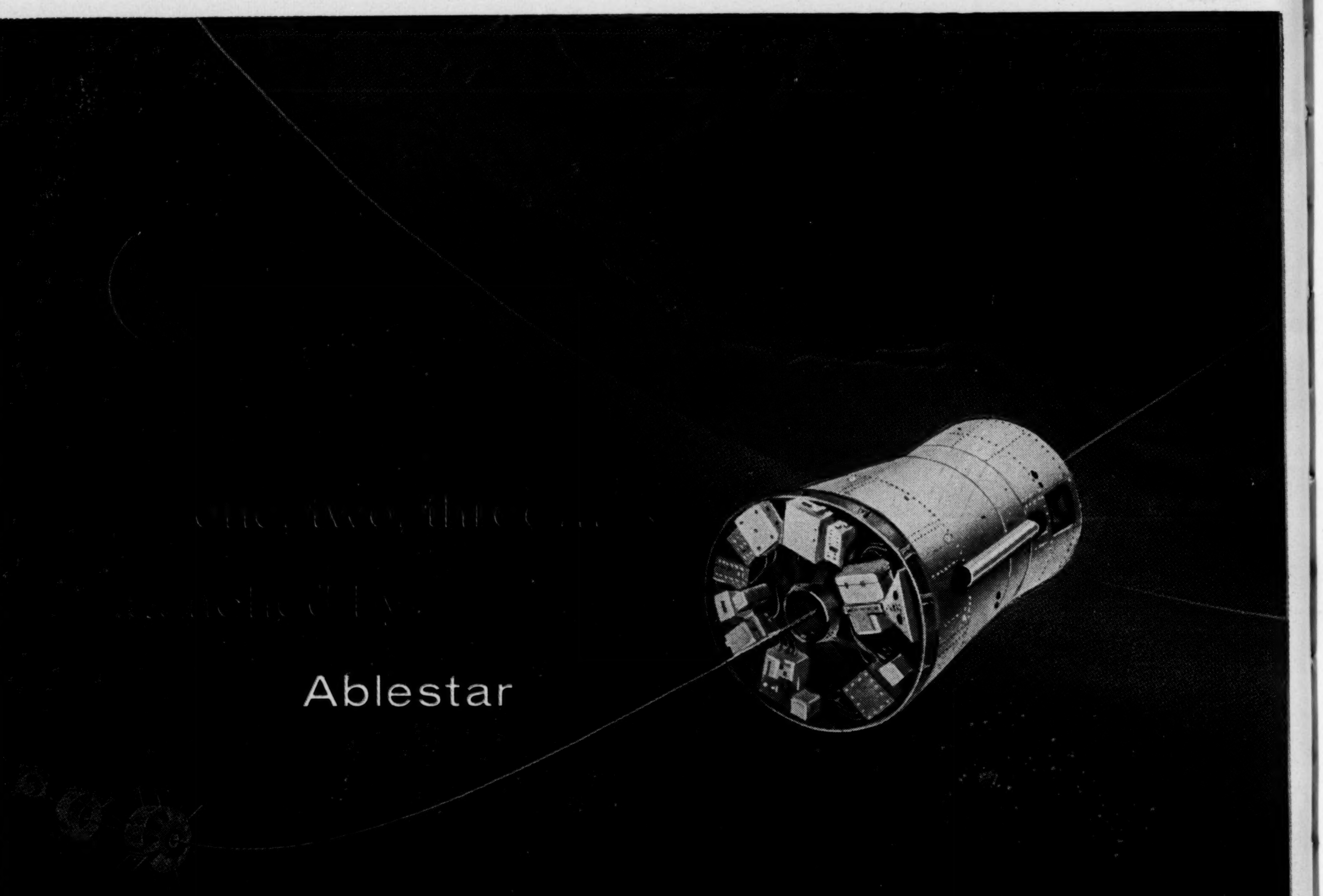


Launches target drones



Lands on snow & ice





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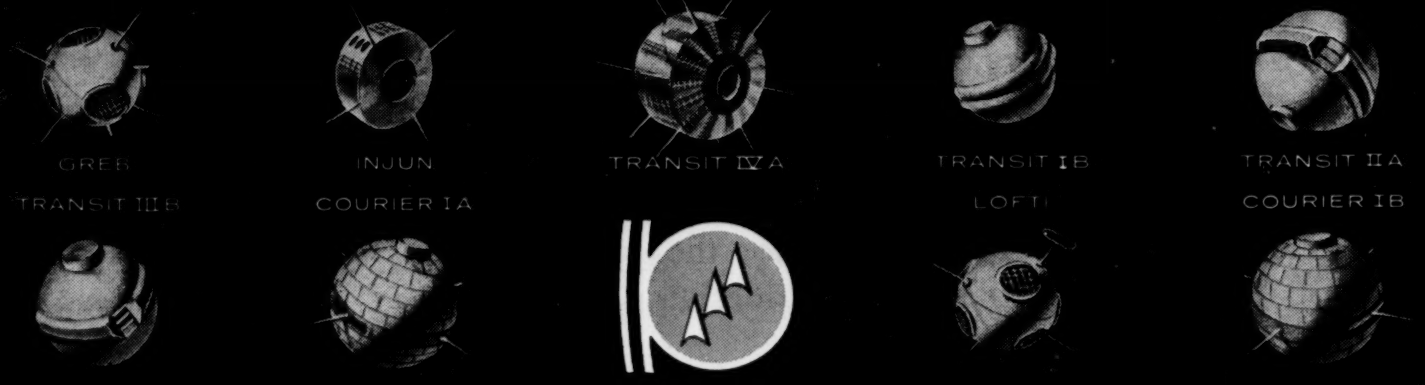
▸▸ The reliable Ablestar space vehicle recently added to its roster of accomplishments by lofting the space "triplets" Transit IV A, Injun and Greb into orbit. Satellites boosted by Ablestar now total nine . . . an unmatched record. ▸▸ Controlled from earth, restarted in space, Ablestar blends boldness in concept with simplicity and economy in detail and construction. Ablestar is a product of Space-General Corporation. America's uniquely capable source for complete space systems.

▸▸ Other advanced launching vehicles, commercial and navigational satellites, lunar landing systems, space-based weapon systems and nuclear-powered space vehicles are among new accomplishments-in-the-making at Space-General.



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of the Russian S.F.S.R.

13. Dr. Topchiev gave as examples the Institutes of Complex Transportation Problems, Metallurgy, and Hydraulic Engineering and Water Economy. In addition, the Institute of Mining will be transferred from the Academy [*Vestnik Akad. Nauk.* 31, No. 4, 3 (1961)].
14. Dr. Topchiev gave the following examples: in the Geography-Geology Division, Institutes of Geological Prospecting and of Coal Geology; in the Chemical Division, Institutes of Silicate Chemistry and of Forestry and Wood Chemistry; in the Biological Division, the Institute of Soil Sciences.
15. *Ekonomicheskaia gazeta* (20 Apr. 1961).
16. *Pravda* (20 May 1961); *Ekonomicheskaia gazeta* (20 May 1961).
17. Some of the Academy's institutes which deal with long-range planning, such as the Institute of Complex Transportation Problems, have been transferred to the operating auspices of the State Economic Council.
18. This was especially emphasized by Dr. Topchiev.
19. *Pravda* (21 Apr. 1961).

Nimbus to Use PCM Telemetry System

Data from the National Aeronautics and Space Administration's Nimbus meteorological satellite will be transmitted to ground stations by a low-power, pulse code modulation telemetry system, now under development by Radiation, Inc., Melbourne, Fla.

The 30-lb. system will be "on" only when data is being transmitted and is expected to use about 1.4 watts.

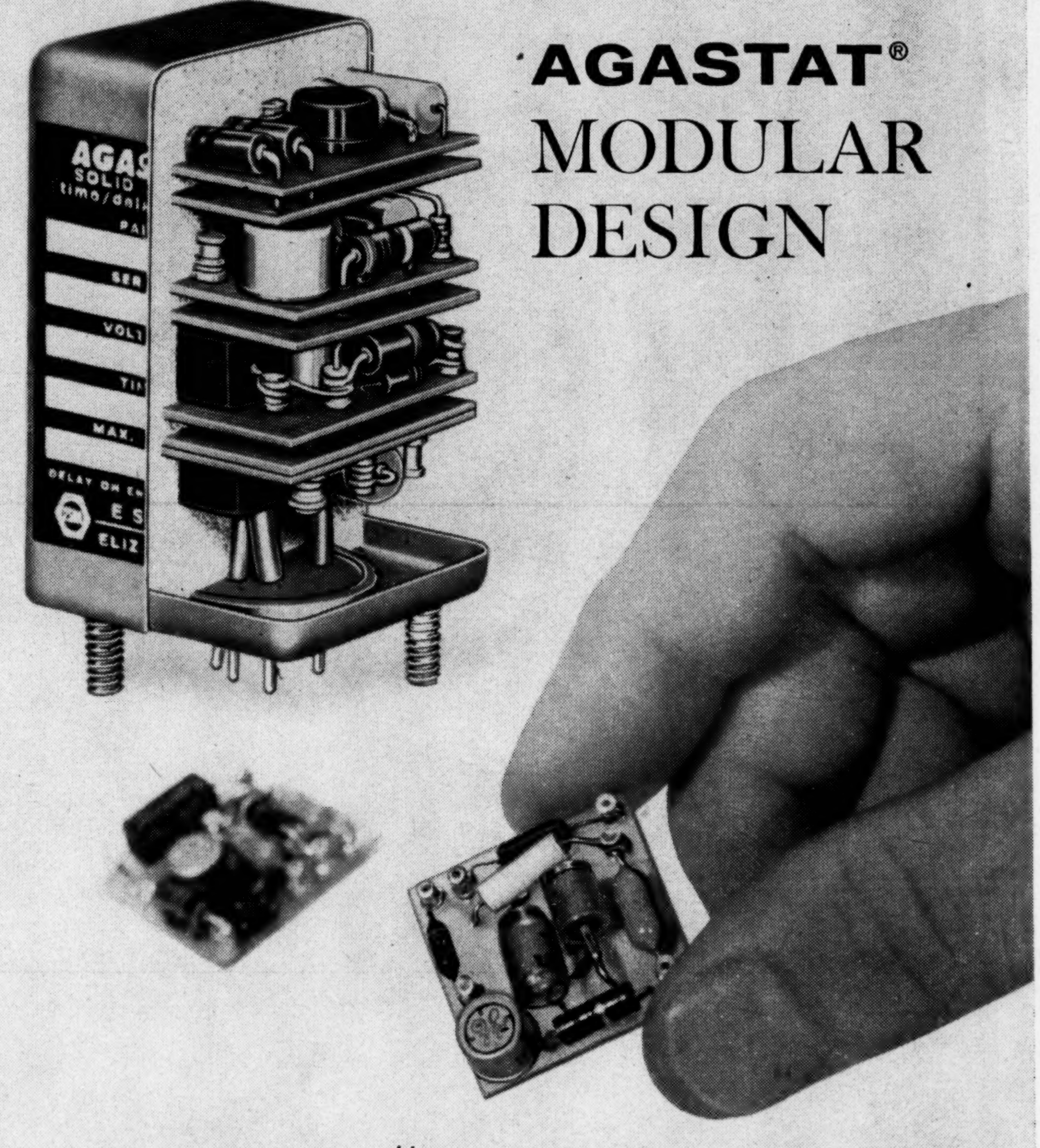
The Radiation system consists of two separate and independent PCM systems, A and B. The 1-watt A unit handles 540 channels and monitors the performance of such equipment as the attitude control system, gyros and radiometers and such physical parameters as voltages, currents and temperatures. This information is stored on tape at 500 cps. and played back, upon ground station command, at 15,000 cps.

The B unit, consuming 0.4 watts, operates directly upon ground command on 128 channels. Less critical data is transmitted at slow speed during a 1.75-min. reporting period. The satellite is expected to be within range of any ground station for about 18 min.

NASA recently awarded a contract for about $1 million to Radiation, Inc., for Nimbus PCM ground equipment.

CO₂ Control Unit

New York—Prototype model of spacecraft carbon dioxide control system has been developed by Hamilton Standard Division of United Aircraft. The 60-lb. system, which can accommodate between three to six men, uses four canisters—two filled with silica gel to remove moisture and two filled with zeolite to trap carbon dioxide. Grouped in two pairs of one silica and one zeolite can each, one set is purged as the other operates.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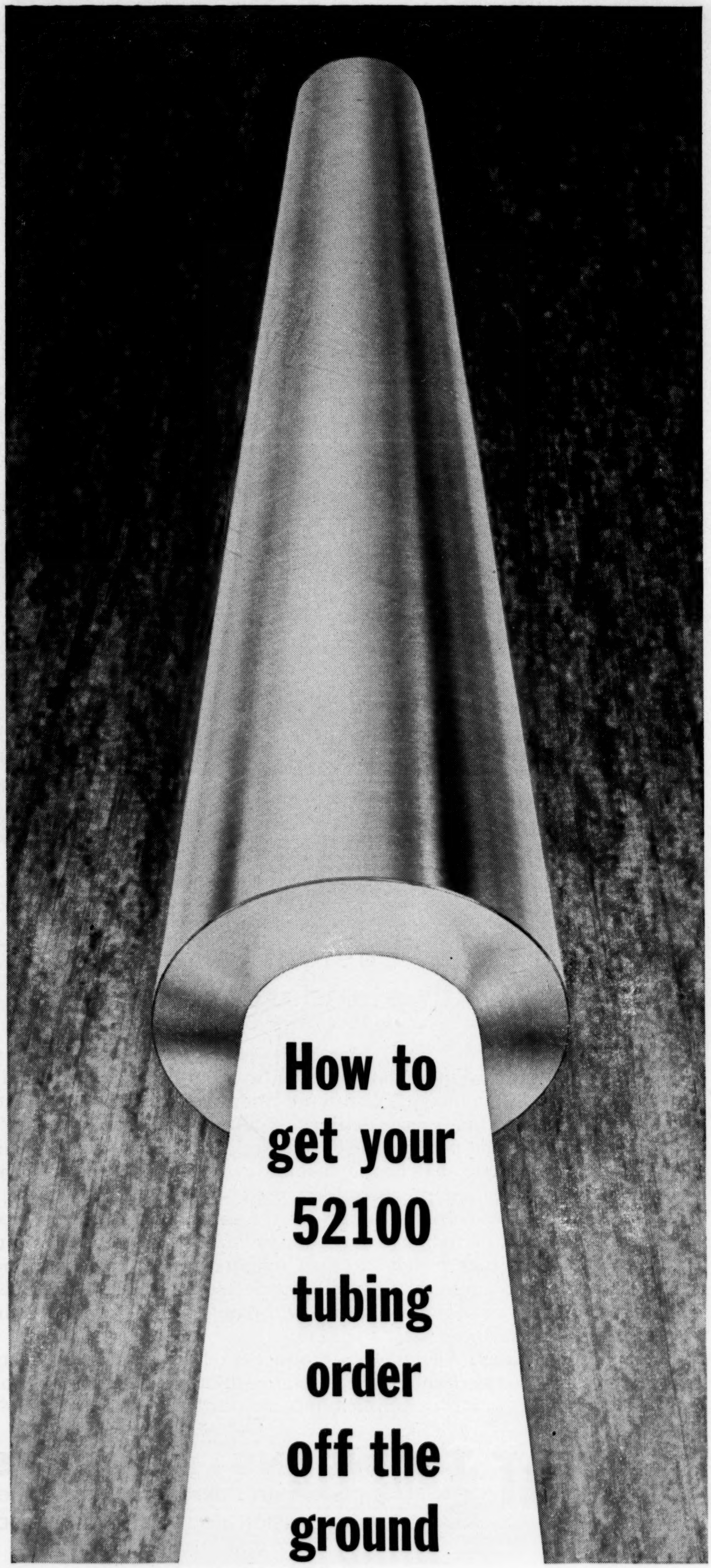

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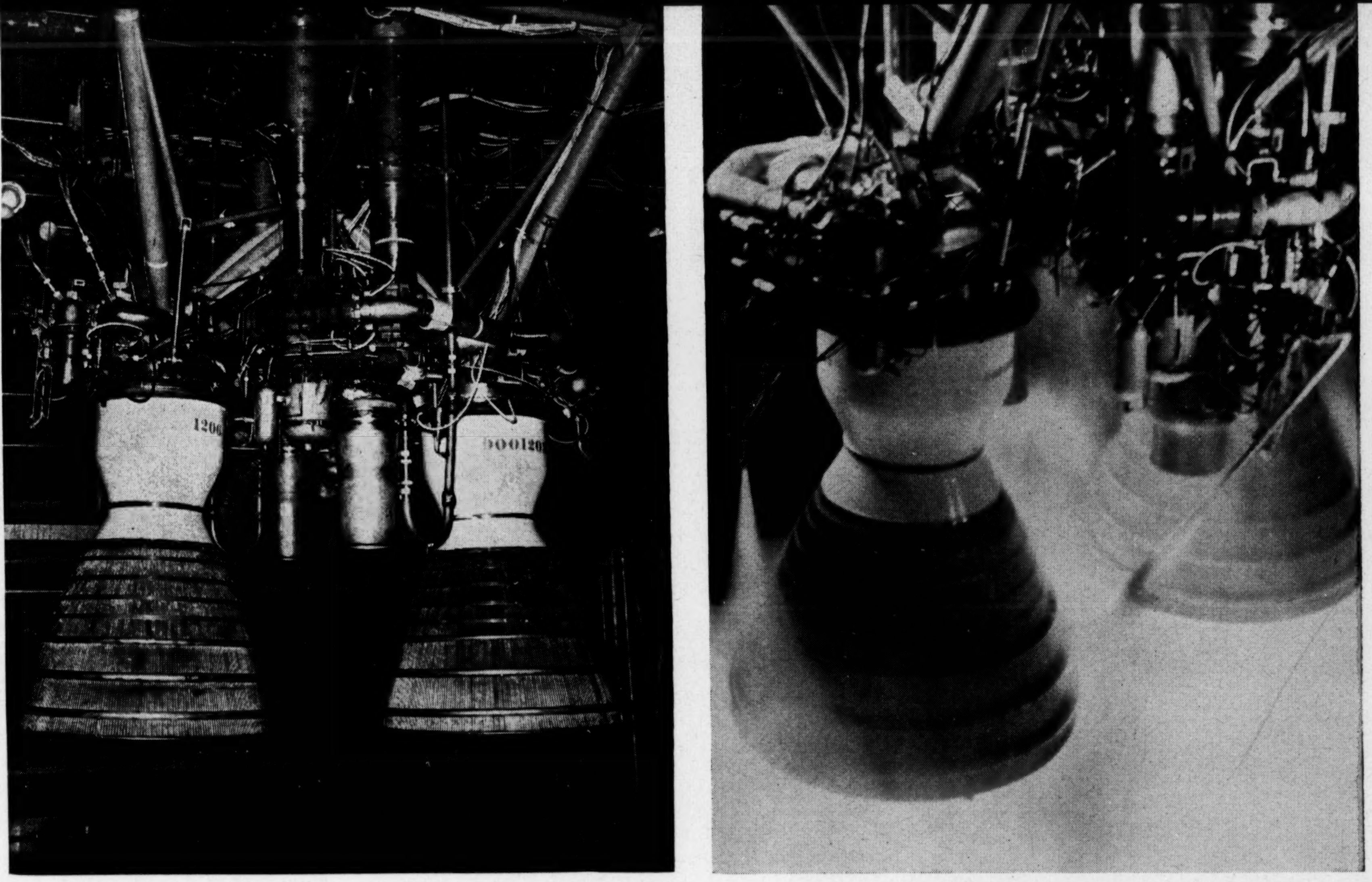
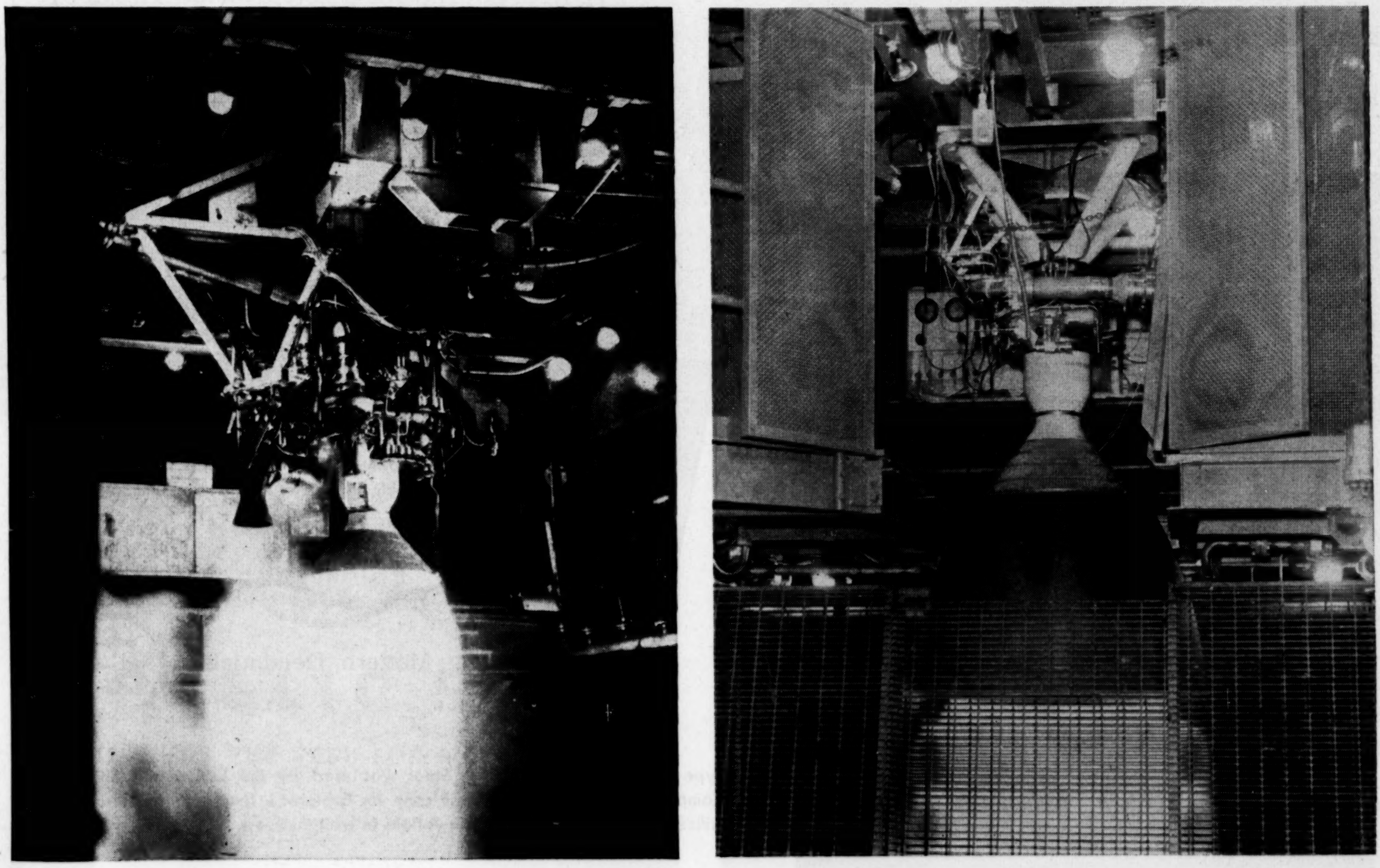
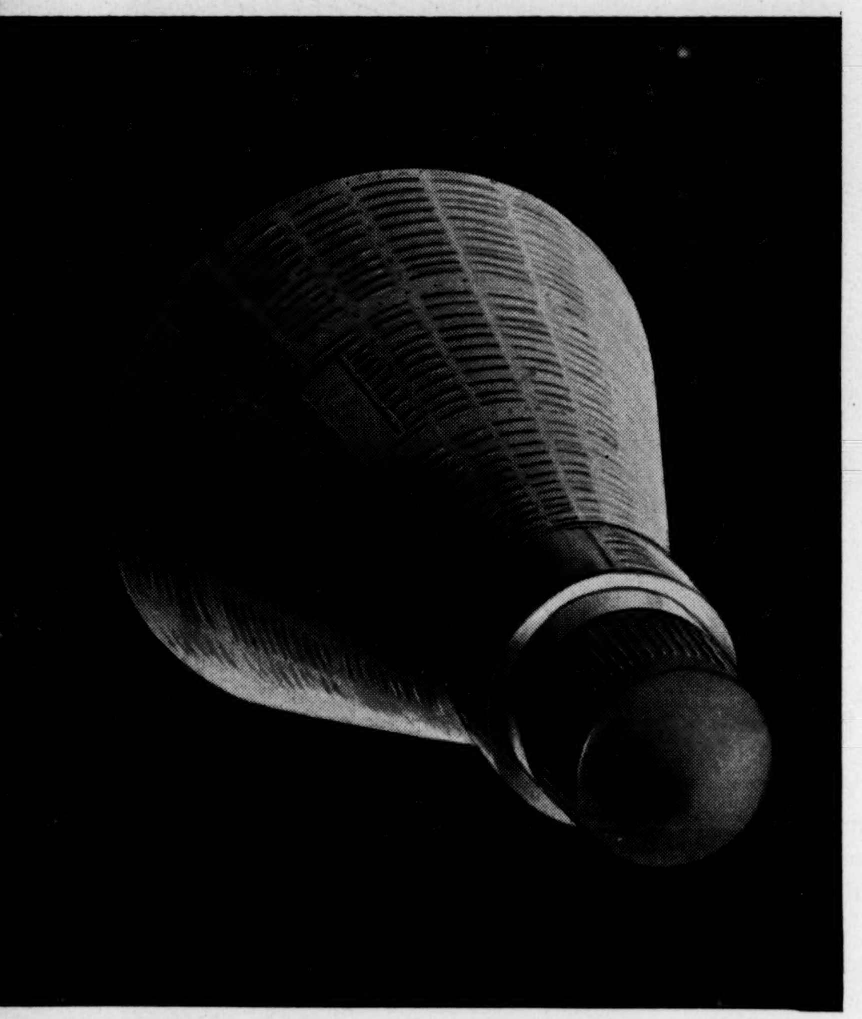


First and Second Stage Engines of Titan II Tested at Aerojet Plant

Titan II second stage engine is fired with (below) and without its ablative skirt (AW Feb. 20, p. 33) at Aerojet-General's Sacramento, Calif., test facility. The engine develops about 100,000 lb. thrust at altitude. First-stage engines (above) are shown prior to firing and during a run. Thrust level of the first stage engines is rated at 430,000 lb. Both powerplants burn hypergolic fuels—equal parts of anhydrous hydrazine and unsymmetrical dimethyl hydrazine (UDMH) for the fuel and nitrogen tetroxide for the oxidizer. Flame pattern of hypergolic fuels is more translucent than that of cryogenic propellants.



DESTINATION: 500,000 PSI



Republic is a major supplier of titanium in the Mercury Project. The titanium—AMS4901—is used in the vehicle's double wall stringer construction.

New steels for space with tensile strengths even beyond 500,000 psi are the target of Republic research.

In the development, unwanted microscopic inclusions of foreign matter like the one circled (magnified 19,000 times by the electron microscope) are studied, analyzed, and identified.

To permit thorough analysis, these inclusions are carefully removed from surrounding steel. How? By a drill small enough to put two holes, side by side, across the thickness of a *human hair*.

Largest producer of stainless and alloy steels, Republic has one of the most extensive vacuum melting capabilities in the world. And it is the purification by vacuum melting that substantially increases the strength and reliability of steels for space.

A new source for Precipitation Hardenable Stainless Steels . . . the *only* source of continuous rolled stainless sheet up to 60 inches wide . . . Republic offers expert metallurgical service. For information, contact your nearest Republic sales office or mail the coupon.

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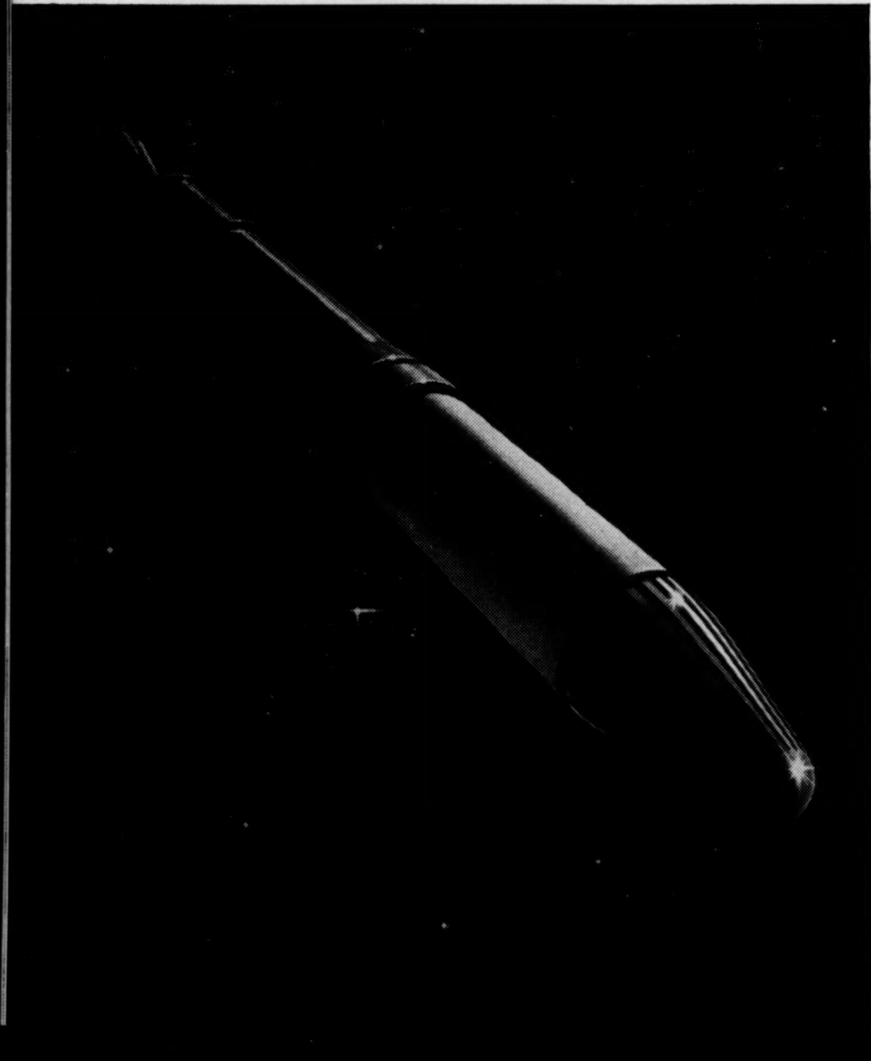

Type 430 Republic Stainless Steel was used by the Lodge and Shipley Company in fabricating the nose cone for Explorer I. The Floturn process was utilized to produce specified deviations in wall thickness.

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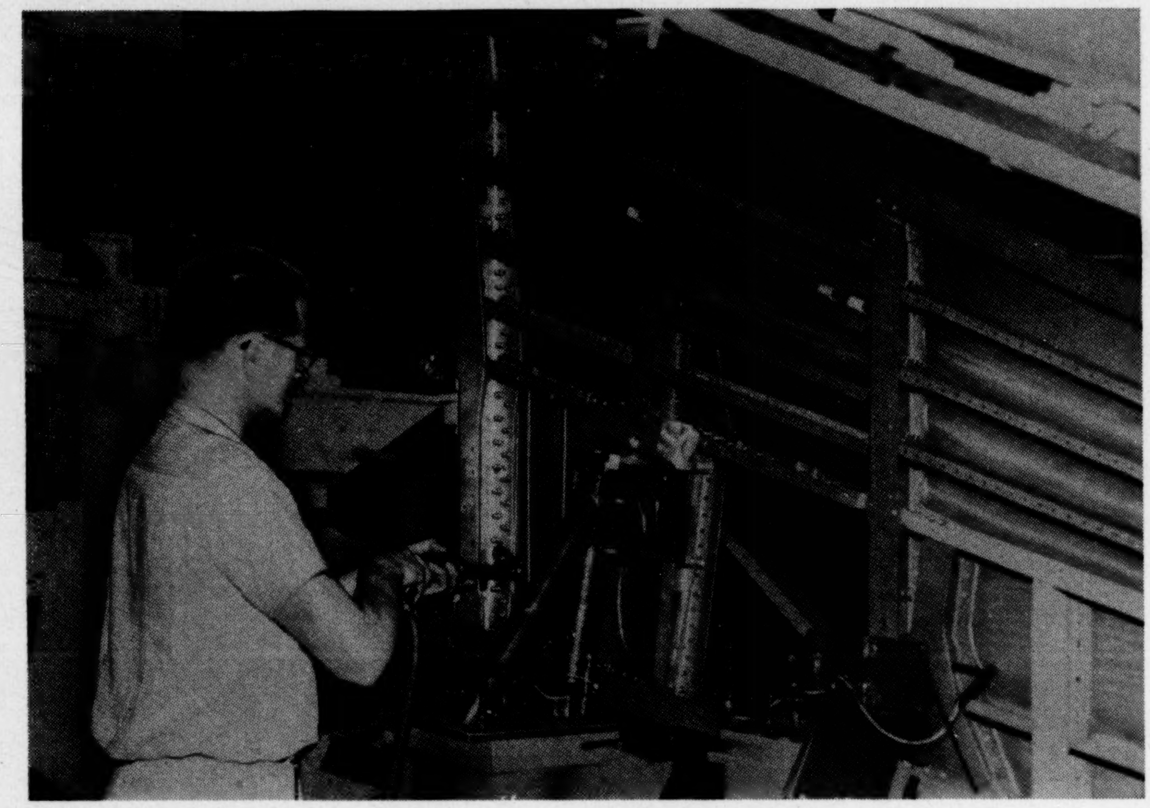
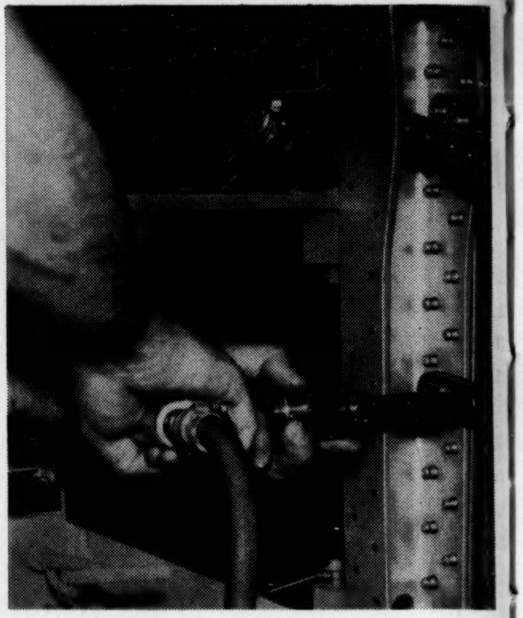




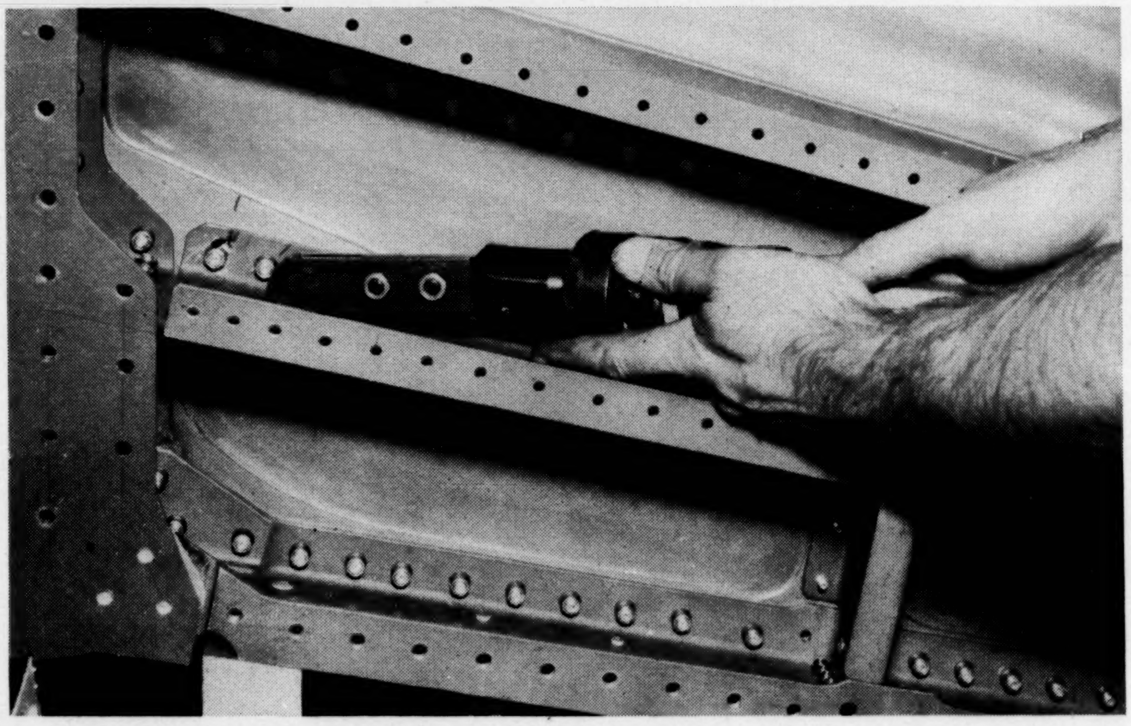
Hi-Lok 2" offset extended adaptor fitted to an Ingersoll-Rand Air Motor reduces a 2-man, 32-hour assembly job on the landing gear steel support rib to a one-man, 4-hour job. Additionally, the change to Hi-Loks reduced the installed fastener rejection rate from 30% to practically nil.

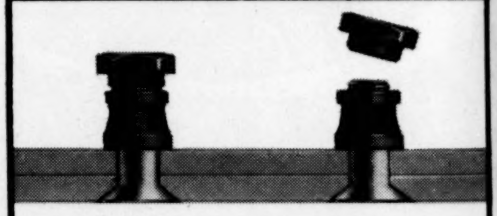
Upper photo: Hi-Loks fasten the entire lower skin panel to ribs and beams.

Lower photo: Modified 20° attachment tool on Keller Air Driver installs Hi-Loks on beam flanges. The Hi-Lok installation is quiet and eliminates the progressive pounding to the structure normally associated with the installation of swage type fasteners using pneumatic hammers.

hi-Lok*

FASTENER CUTS 32 HOUR JOB TO 4





CONTROLLED PRELOAD...the torque-off feature of the Hi-Lok collar *automatically* gives a preload condition *consistent within ±10%*. Because of the torque-off feature, torque wrench inspection after installation is not required.

HI-LOK OFFSET TOOLING CIRCUMVENTS STRUCTURAL FLANGES

The change to high strength Hi-Lok Fasteners and Hi-Lok tooling on the Northrop T-38 Talon supersonic jet trainer, overcame acute accessibility problems caused by wide flanges on structural ribs and beams in the thin, single panel wing. The switch to Hi-Loks from swage type fasteners resulted in a substantial savings in installation manhours.

More than a 50% tool cost savings alone was realized at Northrop when swage fastener tooling, with its single purpose power units, squeezer yokes and other special tooling was replaced with simple Hi-Lok offset tooling adapted to standard, multi-purpose air driver motors.

Installation rates up to 45 Hi-Loks per minute are obtainable using automatic drivers where the structure is open and when speed of installation is essential.

Contact your Engineering Standards Group or write directly to us for additional data on Hi-Loks and our other fastener products.

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FINANCIAL

Financial Briefs

Consolidated sales of Tenney Engineering, Inc., of Union, N. J., rose to a record $3,272,861 during the first six months of 1961, with net income totaling $10,736 or two cents per share on 591,403 shares outstanding. This compared with a deficit of $55,822 on a volume of $2,359,989 during the comparable period in 1960. The company, which manufactures orbital simulators and environmental, electronic and ground support test equipment, had a June 30 backlog of $4 million.

Bureau of the Census reported $39.4 million total value on shipment of aircraft propellers and parts by plants manufacturing complete propellers, a 15% decrease over the same period of 1960 when shipments totaled $46.5 million but an increase of 6% over the last six months of 1960 when shipments were valued at $37.1 million.

Air Express International Corp. President Alvin B. Beck predicted 1961 gross revenues will exceed $16 million for a new company record. He based his prediction on a 33% increase in billings for the New York firm during the first half of 1961 compared with the same period in 1960. January-June 1961 billings totaled $7,430,320 as opposed to $5,870,073 for January-June 1960. Beck noted that AEI's average weight per consolidated shipment eastbound over the North Atlantic rose from 57 lb. in January-June 1960 to 63 lb. for the same 1961 period.

General Precision Equipment Corp., Tarrytown, N.Y., reported a record 5% rise in net operating income for the first six months of 1961 despite a 1.5% drop in sales compared with the same period a year ago. Sales for January-June 1961 were $118,903,557 with an income of $2,488,704 compared with January-June 1960 sales of $120,722,804 and income of $2,369,183. The company, manufacturer of electronic systems and components, computers and data processors for military and industry, declared a 30-cent dividend per common share payable Sept. 15 to stockholders of record on Aug. 31 and quarterly dividends on the $4.75 cumulative preferred and $1.60 cumulative convertible preference stock. Backlog on June 30 was $187.8 million.

Greer Hydraulics, Inc., of Los Angeles reported first-half 1961 net earnings of $126,356 on net sales of $2,336,999, highest first-half earnings since

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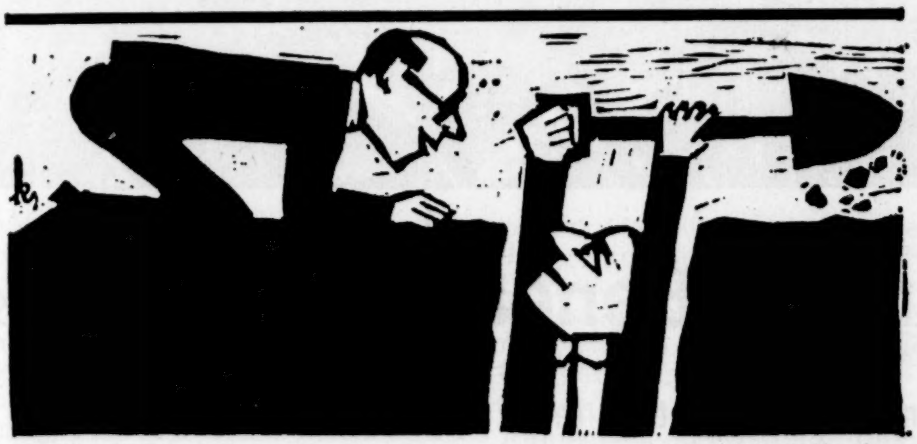
PROBLEMATICAL RECREATIONS 83



While visiting Cape Canaveral, we came upon an engineer digging a hole. "How deep is that hole?" we asked. "Guess," said the engineer, being evasive. "My height is exactly 5'10"." "How much deeper are you going?" we inquired. "I am one-third done," was the answer, "and then my head will be twice as far below ground as it is now above ground." How deep will that hole be when finished? *—Contributed*

Studies in depth are expected from the newly-formed Litton Geophysical Projects Office, a teaming up of four Litton divisions to initiate and direct programs in oceanography. Pooling their capabilities in this relatively new field are the Advanced Development Laboratory, the Maryland and Westrex divisions of Litton Systems, Inc., and our Western Geophysical Company.

ANSWER TO LAST WEEK'S PROBLEM: 1187010

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Beverly Hills, California

Beneath a field like this...

is a complex communications center

In minutes, an enemy attack could level some of our sprawling cities.

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Under the protection of a thick earth and concrete cover, and away from major target areas, several Bell System communications centers are already in operation. Many more are to come.

The walls for these installations are huge, reinforced concrete slabs. Ventilation systems filter air so fine that even radioactive fallout cannot enter. Food and water are stockpiled. Living quarters are provided for all operating personnel.

These buildings are costly. Tough to build.

Yet, the Bell System recognizes that communications are the lifelines of our defense systems. And so we took the lead in establishing these underground centers with our own money.

There are many other ingenious projects in our "Survivability" program for America's communications. Many cannot be mentioned here.

Because of them, ambitious command, control and defense systems are feasible. And our vast existing network is available for further *tailor-made* defense communications.

BELL TELEPHONE SYSTEM

AMERICAN TEL. & TEL. CO. / WESTERN ELECTRIC CO. / BELL TELEPHONE LABORATORIES / 21 OPERATING COMPANIES

1953. This compares with a net loss of $70,566 on $2,004,925 net sales for January-June 1960. The company, designer and producer of test and ground support equipment for missiles and aircraft, integrated fluid mechanical systems, accumulators, valves and other components, announced net income of 24 cents per share on 529,063 common shares outstanding as of June 30. During the first half of 1960 the firm had a loss of 13 cents per share on the same number of common shares.

New Offerings

CompuDyne Corp., Hatboro, Pa.; engaged in furnishing instruments and systems for missile sites and in the design, development, assembly and manufacture of electronic and other devices and systems used in aeronautical and missile test facilities. Offering is 168,000 shares of common stock for public sale; 120,000 shares for sale by the company and 48,000 outstanding shares by the present holders thereof. Offering, made on an all or none basis with price and underwriting terms to be supplied by amendment, includes: 18,182 common shares which may be issued on conversion of the company's 5% convertible subordinated sinking fund debentures due June 15, 1970; 8,000 common shares purchased at $3 per share by the principal underwriter upon exercise of an option granted in 1959. Proceeds from the company's sale will be applied to expand inventories; to redeem 6% debentures due December 1, 1961; the balance will be added to working capital for general corporate purposes.

Cal-Val Research and Development Corp., Woodland Hills Calif.; organized under Delaware law in May, 1960, the company has acquired all the assets and assumed the liabilities of Cal-Val Research and Development Corp. which was organized under California law in January 1958. The company is engaged in ground support equipment in the missile and space fields. Offering is 200,000 shares of capital stock for public sale; public offering price and underwriting terms to be supplied by amendment.

Recently the company signed an agreement with Greater Washington Industrial Investments, Inc. whereby the latter agreed to loan the company up to $500,000 in 5-year 8% debentures and to provide it certain consultant services without compensation for three years. Proceeds will be used to repay a $90,000 bank note; to prepay an unspecified amount of the aforementioned 8% debentures; to pay a $30,000 demand note; the balance will be available for general corporate purposes.

KNOW-HOW IN ACTION AT BENDIX PIONEER-CENTRAL

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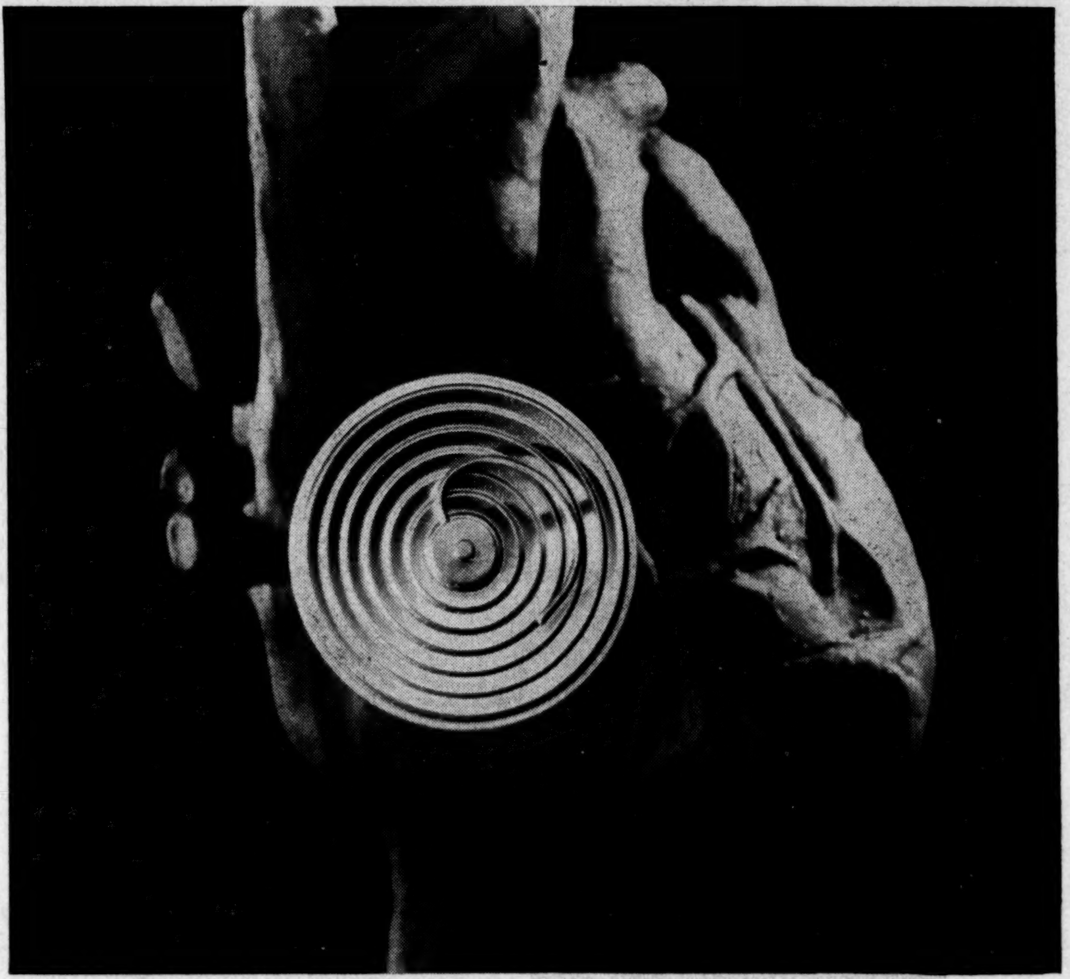

The "heart" of any pressure sensing instrument is its diaphragm or aneroid capsule. Pioneer-Central "know-how" assures maximum capsule accuracy.

EXTRA QUALITY IN DIAPHRAGMS AND ANEROIDS FOR PRECISION INSTRUMENTS

Special machinery has been designed and built at Pioneer-Central for manufacturing and testing diaphragm and aneroid capsules. This machinery—along with our highly trained personnel—makes possible the manufacture of capsules so *sensitive* they are calibrated with hairspring adjustments and so *rugged* they can withstand overpressures of fifteen times their working pressures.

Hysteresis problems have also been effectively eliminated by our ability to measure hysteresis characteristics to within .00002 inch.

Our pressure sensing instruments reflect forty-two years' experience. They include: Altimeters; Rate of Climb, Airspeed, and Mach Number Indicators; and Control Devices for use in such applications as Oxygen Regulators.

Other areas of outstanding Pioneer-Central capabilities include Inertia Sensing, Cryogenics, Life Support, Propellant Control, and Acoustical Engineering.

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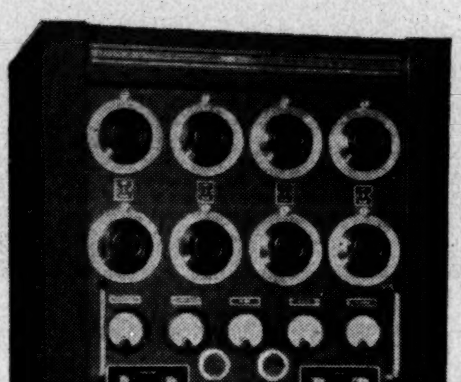

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This transmitter operates on 4 crystal-controlled frequencies (plus 2 closely spaced frequencies) in the band 2.5-24.0 Mcs (1.6-2.5 Mcs available). Operates on one frequency at a time; channeling time 2 seconds. Carrier power 350 watts, A1 or A3. Stability .003%. Nominal 220 volt, 50/60 cycle supply. Conservatively rated, sturdily constructed. Complete technical data on request.

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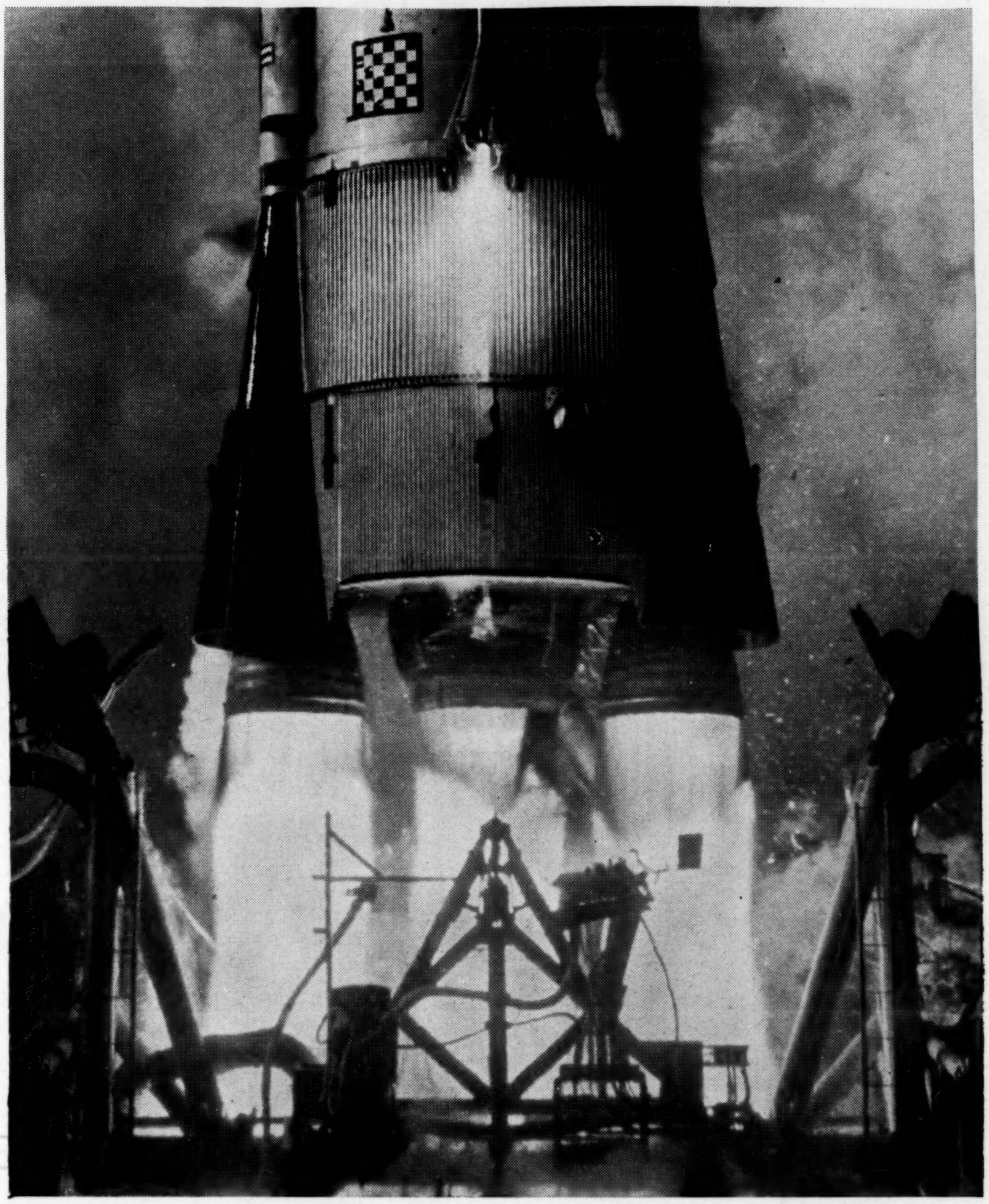

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"Soft" mounting will get your project off the ground more reliably

Here are the hard facts:

■ Soft mounting—or the use of engineered protective suspensions—has become the preferred method for boosting the reliability of aerospace equipment.

As applied by experienced Lord engineers, this technique provides an optimized system for protection against severe vibration/shock/noise environments. Here's why:

Soft mounting reduces the effects of dynamic disturbances to safe, predictable levels. Isolation efficiencies are compatible with equipment response characteristics.

Soft mounting can provide the performance versatility to control low, high or broad frequency vibration plus shock.

Soft mounting avoids direct attachment of the equipment to the structure where vibration levels are often an unknown factor.

Soft mounting combines damping and elasticity in an engineered package compatible with tight-space limitations.

Soft mounting ends the danger of local or unforeseen resonant responses causing damage or equipment malfunction.

Soft mounting offers cost and weight savings compared to ruggedization. "Beefing up" is avoided and lighter components can be used.

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Soft mounting has increased the reliability of equipment for such projects as Atlas, Titan, Polaris, Hawk, Centaur, Minuteman, Mercury, low-level B-52, X-15 and others.

Lord offers aerospace designers proved capabilities in the design, production and testing of soft mounting systems. A call to the nearest Lord Field Engineering Office or the Home Office, Erie, Pa. will put you in touch with the specialists in vibration/shock/noise control.

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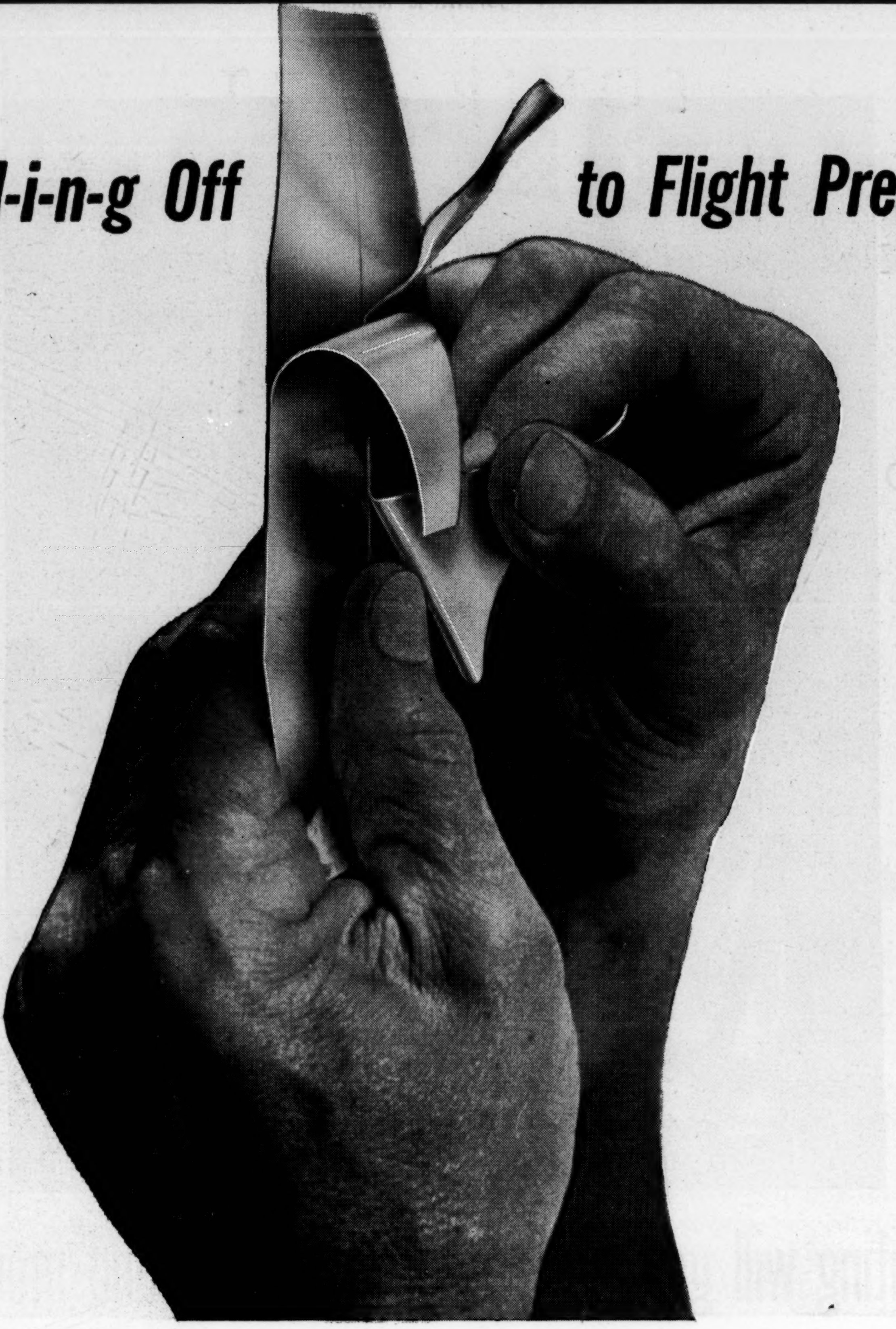


P-e-e-l-i-n-g Off to Flight Precision

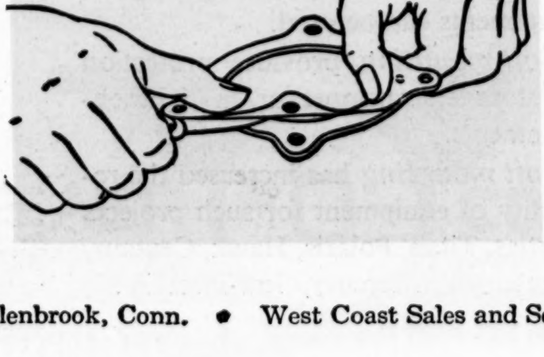
It's a Shim made of LAMINUM® of course, meeting the close tolerances of sophisticated aircraft in a matter of seconds!

LAMINUM is the registered name for laminated shim stock that looks and acts like solid metal. Plastic bonded or metallic bonded, the laminations p-e-e-l off easily to give you a thousandth fit—right at the job.

No machining. No grinding. No counting. No stacking. No miking. And no costly stand-by equipment.

Shims of LAMINUM, custom-made to your own rigid specifications are quickly available from the oldest specialists in the country—serving aircraft and all metalworking since 1913! In Brass, Mild Steel, Type 302 Stainless and in Aluminum—with laminations of .002″ or .003″. **And now also in Titanium with laminations of .003″!** Any shape. Any size. Any quantity.

An inquiry will bring you the time-saving, cost-saving story of LAMINUM along with our recently published DESIGN FOLDER NO. 4 with complete up-to-the-minute engineering data. If you're in a hurry—phone Templebar 6-1440 in Oakland, or Davis 5-2631 in Glenbrook.



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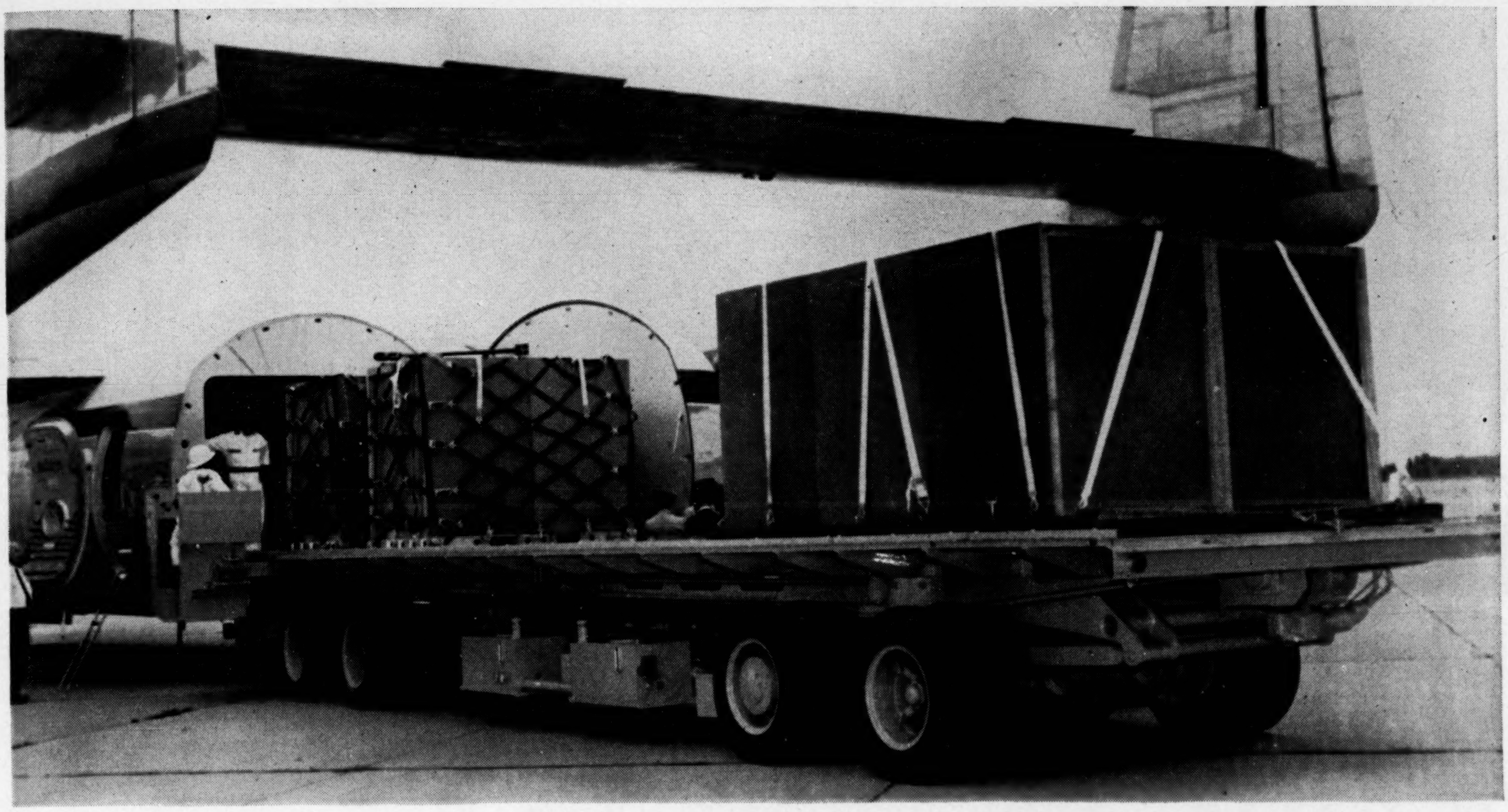
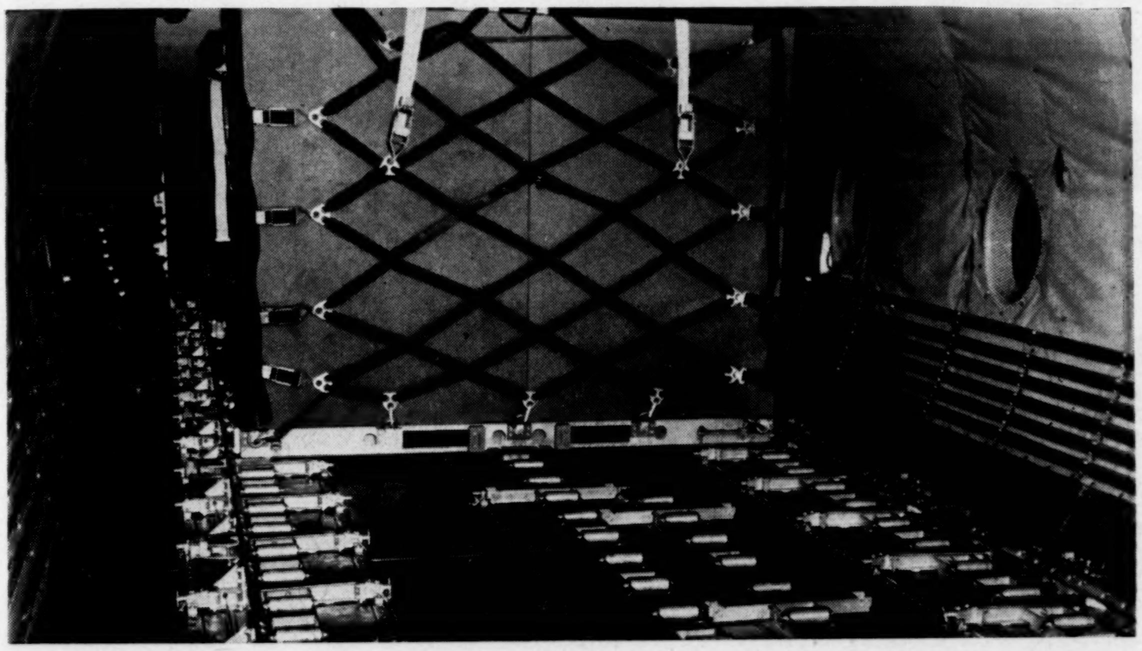
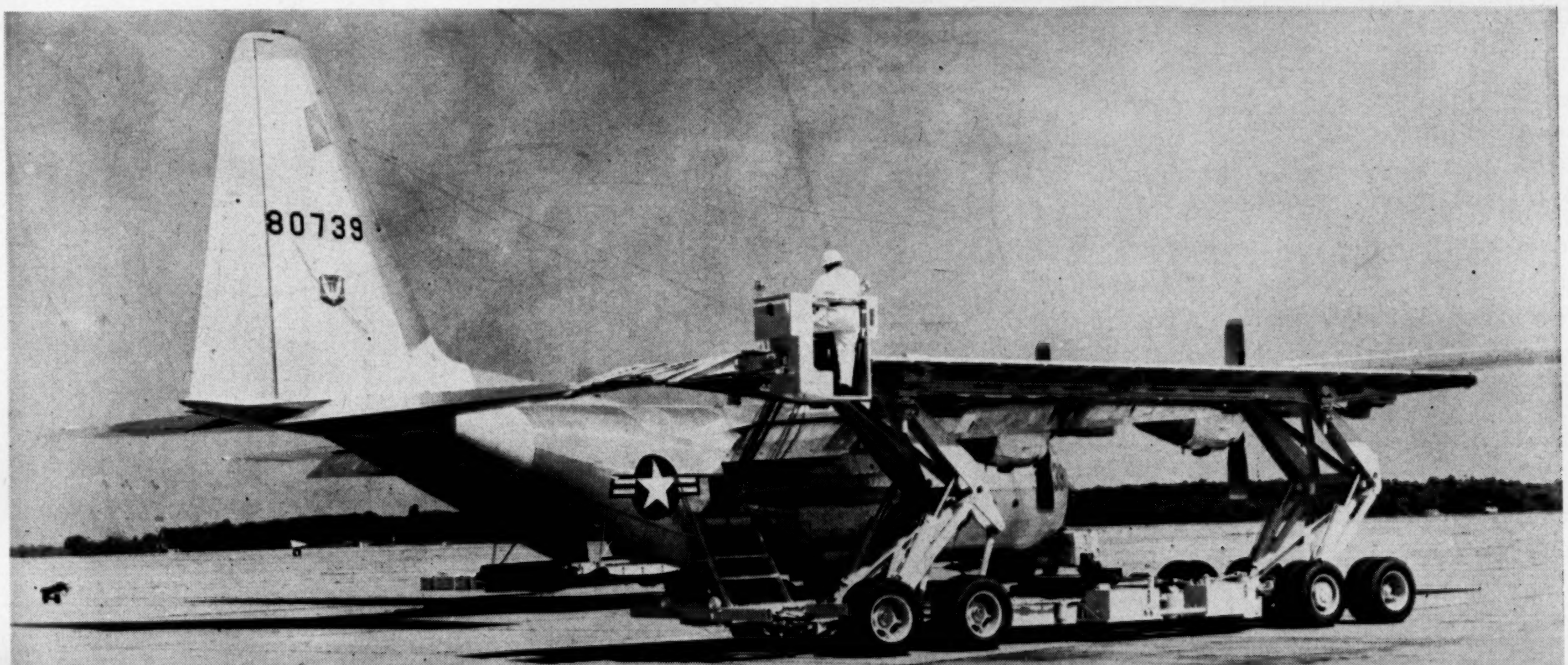


Air Force Cargo Loader Adjusts to Aircraft Position

Self-propelled cargo loader and a universal cargo handling system, which together constitute the basis for the Air Force 463L Materials Handling Support System, were demonstrated recently at Stewart AFB, N. Y. Built by American Machine and Foundry Co., the automatic cargo loader incorporates a high-lift loading platform, which can transport and lift its 40,000-lb. load to any height between 40 in. and 13 ft. The platform can be raised, lowered, pitched and rolled in response to the aircraft. Two remotely controlled pallet conveyance mechanisms are used separately or coordinately to move cargo from the loader platform into the aircraft compartment. During the demonstration, the lift platform was adjusted to handle cargo, general skidded cargo and fully loaded vehicles in less then 15 min.





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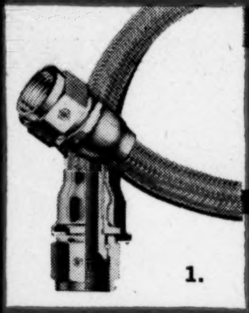
NO TIME FOR FITTING FAILURE!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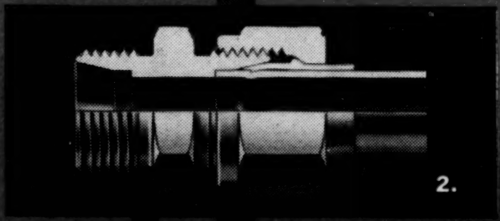
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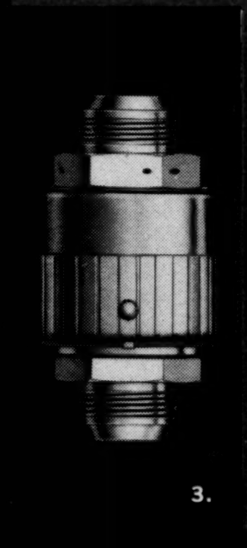
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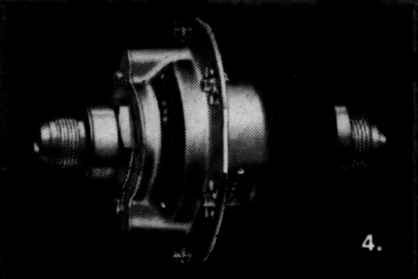
4.

[illegible] has full meaning.

Meeting the critical needs of today's aircraft, missile and support equipment are Weatherhead precision fluid power components such as: (1) Teflon armor-plated hose assemblies combining the unique properties of Teflon with durable, leakproof Braid-Lok end fittings; (2) a complete range of MS (ER) flareless fittings designed to withstand the most severe applications; (3) quick disconnect, self-sealing couplings for straight-through flow with positive safety locking; and (4) breakaway couplings and regulators for missile guidance system power. These are only a few of the many Weatherhead standard and special precision aircraft products that give real meaning to "reliability".

Put Weatherhead's unique capabilities to work on your special fluid system requirements . . . from basic design to production.

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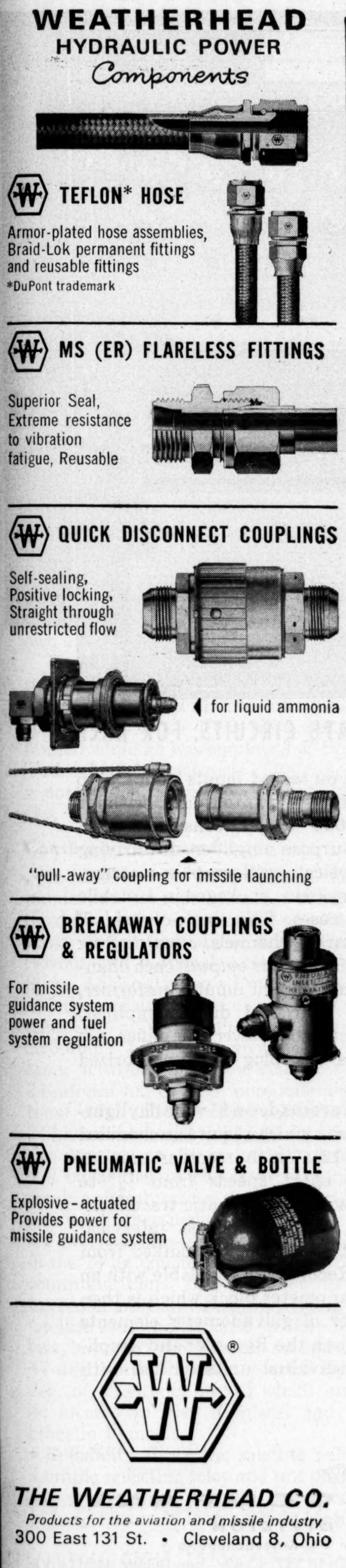

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HYDRAULIC POWER
Components

TEFLON* HOSE
Armor-plated hose assemblies, Braid-Lok permanent fittings and reusable fittings
*DuPont trademark

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Superior Seal, Extreme resistance to vibration fatigue, Reusable

QUICK DISCONNECT COUPLINGS
Self-sealing, Positive locking, Straight through unrestricted flow

for liquid ammonia

"pull-away" coupling for missile launching

BREAKAWAY COUPLINGS & REGULATORS
For missile guidance system power and fuel system regulation

PNEUMATIC VALVE & BOTTLE
Explosive-actuated Provides power for missile guidance system

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Products for the aviation and missile industry
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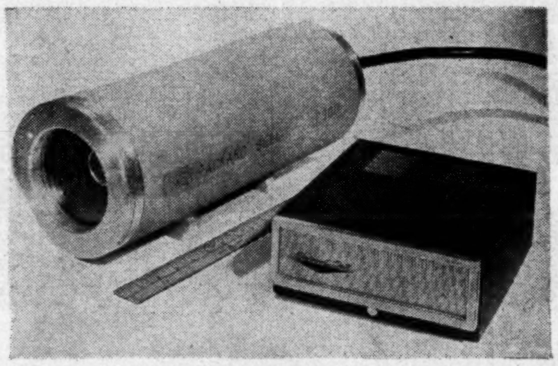
NEW AEROSPACE PRODUCTS

Closed-Circuit TV Camera

High resolution closed-circuit television camera system, now being tested by the Army in tank maneuvers at Aberdeen Proving Grounds, is designed for application to missile launch observation as well.

Series 2900 camera is enclosed in an environmental type container to eliminate need for special housing, with etched boards of epoxy impregnated glass fiber for a high indestructibility ratio. Operating specifications reportedly far exceed standards for conditions of explosion, temperature and humidity variations, salt spray, acoustic variation, shock, vibration and altitude.

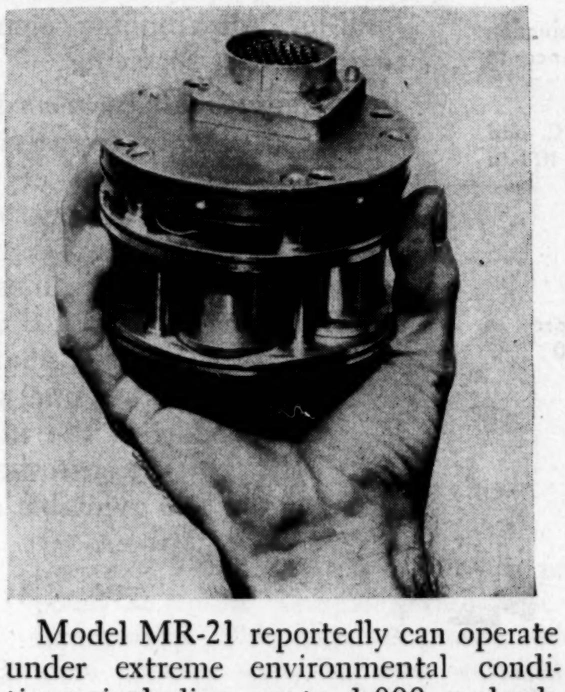


The 2900 camera is 16 in. long with a 6.5 in. diameter. Delivery time is set at 30 days.

Packard Bell Electronics, 1920 S. Figueroa St., Los Angeles 7, Calif.

Miniature Tape Recorder

Miniature recorder, designed to record flight test information on advanced missiles and space vehicles, records data on as many as 14 channels simultaneously on a single 1-in. magnetic tape.



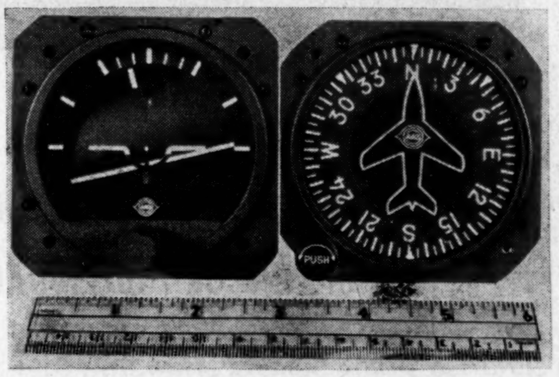
Model MR-21 reportedly can operate under extreme environmental conditions, including up to 1,000 g shock, has a 69-ft. total tape capacity and can record with either a.c. or d.c. input signals. Power requirements are low, and wow and flutter are less than 1% under static conditions. Recorder is 3 in. long with a diameter of 4 in. Environmental conditions include −65F through +165F in storage and operation, vibration through 50-2,000 cps. to 20 g axially and 50-2,000 g at 10 g transverse.

Borg-Warner Controls Division, Borg-Warner Corp., P. O. Box 1679, Santa Ana, Calif.

Vacuum-Driven Gyros

New lightweight, non-tumbling vacuum-driven gyros have upgraded dial presentation. Each instrument fits a standard 3-in. panel cutout and weighs 2.5 lb.

Model 643-S Horizon Reference Indicator (below, left) now has a straight horizon reference bar which eliminates parallax. Model 213-1B Gyro Direction Indicator (above, right) has the course selector knob moved from the dial center to the lower left mounting hole location.



Aviation Instrument Manufacturing Corp., 9033 Monroe Rd., Houston 17, Tex.

3-Axis Telemetry Subsystem

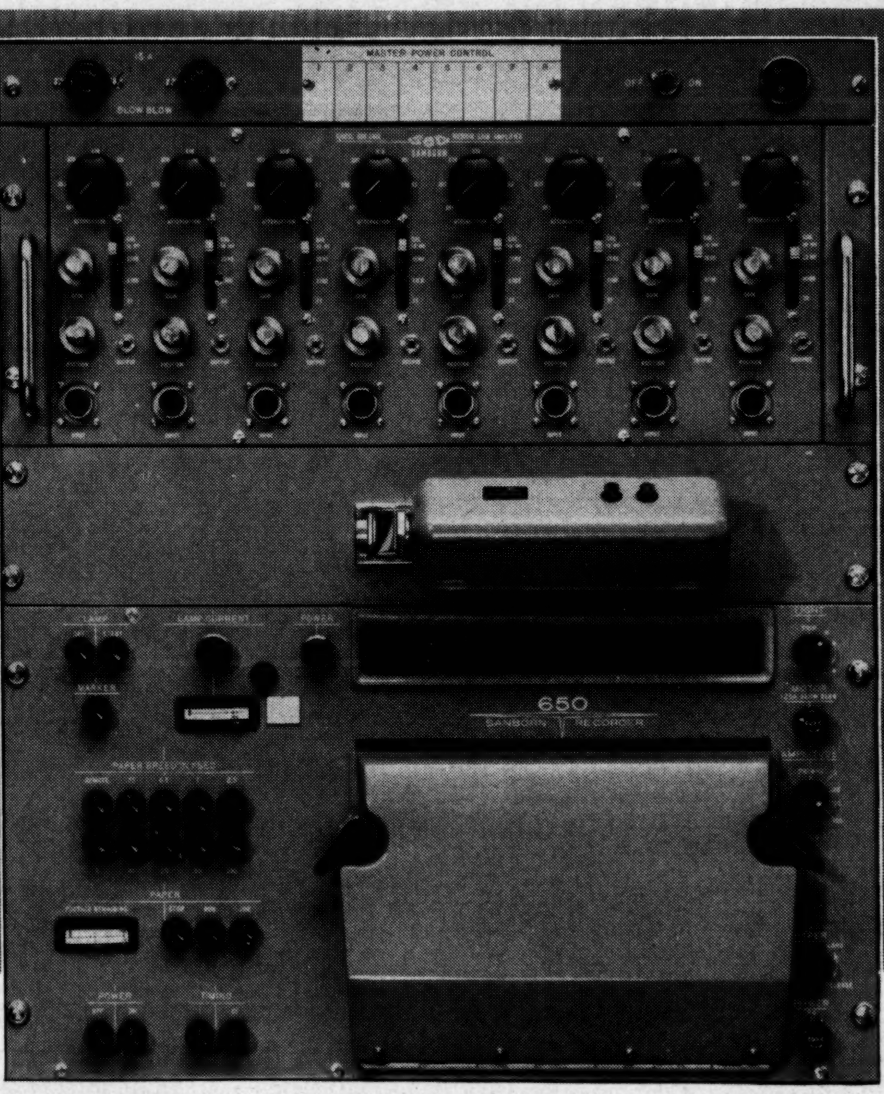
High resolution three-axis telemetry subsystem for use in spin-stabilized missiles incorporates three rate gyros to telemeter pitch, yaw and roll rates.

Reportedly measuring rates accurately during spinning speeds up to 5,000 deg./sec., the self-contained subsystem weighs less than 4 lb. Full-scale input is ± 100 deg./sec. on yaw and pitch and + 5,000 deg./sec. on roll axis. Sensitivity threshold is 0.05% of full scale. Environmental tests have shown the subsystem can withstand 150 g shock for 8 milliseconds on all axes and acceleration of 100 g steady state on all axes.

The three gyros are designed with "self-test" capabilities to allow for easy remote checkout. Made on special order only.

Fairchild Controls Corp., 225 Park Ave., Hicksville, N. Y.

DC to 5000 cycles over an amplitude of 4" peak to peak



NEW SANBORN "650" SYSTEM OFFERS DIRECT READOUT, 8 TO 24 CHANNELS, ALL SOLID STATE CIRCUITS, FOR RACK MOUNTING OR INDIVIDUAL CASES.

Here's the *one* system that lets you record inputs from DC to 5 KC within 3 db at 4" peak-to-peak amplitudes, without changing galvanometers. The "650" system consists of an 8-channel medium gain, general purpose amplifier unit driving a high speed, high resolution optical oscillographic recorder. It can be easily built into your system, packaged in a mobile cabinet or housed in individual cases. The single-chassis, 7" high amplifier module has 8 separate channels, *complete from floating and guarded inputs to galvanometer outputs;* each channel comprises a front end modulator and input transformer, carrier amplifier, demodulator, filter and driver amplifier. Power Supply and Master Oscillator Power Amplifier are built-in. All amplifier elements are plug-in transistorized units for easy servicing.

Immediately readable recordings are made on 8" wide daylight-loading ultra-violet-sensitive charts which require no chemical development. Features of the 12¼" high recorder unit include 9 electrically controlled chart speeds from ¼" to 100"/sec; calibrated monitoring screen; automatic trace identification and timing lines at 0.01 or 0.1 sec. intervals; amplitude lines spaced 0.1" apart which can be blanked from ¼, ½, ¾ or all of chart. Recorder is available with an 8-, 16- or 24-channel galvanometer block which is then equipped with the number of galvanometer elements desired by the customer. Both the Recorder and Amplifier are also available as individual units for use with other equipment.

SENSITIVITY 20 mv input gives 8" deflection; 12 attenuator steps to X5000, smooth gain control.

INPUT RESISTANCE 100,000 ohms all ranges, floating and guarded; DC source resistance must be kept below 1000 ohms on mv ranges only.

COMMON MODE PERFORMANCE Rejection at least 140 db at DC, tolerance to ±500 volts, max.

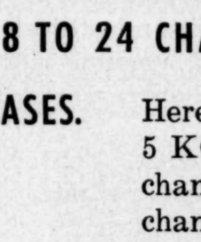
GAIN STABILITY Better than 1% to 50° C. and for line voltage variation from 103 to 127 volts.

LINEARITY 1½% of full scale (8 in.)

NOISE 0.02" peak-to-peak, max.

MONITOR OUTPUT On front panel; provides ±1v full scale across 100,000 ohm load

POWER REQUIREMENTS 103-127 volts, 60 cycle AC, 625 watts



Contact your Sanborn Sales-Engineering Representative for complete specifications and applications engineering assistance. Offices throughout the U. S., Canada and foreign countries.

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175 Wyman St., Waltham 54, Massachusetts

20-Year-Life Comsat Concept Proposed

By Barry Miller

Los Angeles—Concept of a 24-hr. passive communications satellite system using high-gain reflectors and capable of relaying up to 20 television channels between New England and Europe was outlined recently before the Sixth Symposium on Ballistic Missile and Aerospace Technology, a meeting jointly sponsored by the Air Force and Aerospace Corp.

Potentially, the system as described might have a useful lifetime of 20 years because of its inherent simplicity. It would not require active signal amplification nor would the relay satellite itself need an active attitude stabilization system. In one of two proposed forms no stabilization would be needed; in the other, passive stabilization—stabilization by spinning of the satellite about its own axis—is suggested.

The concept represents a series of studies performed by Berl D. Levenson, a member of the technical staff at Aerospace Corp. Much of his work was performed while he was employed at Space Technology Laboratories. The concept is not funded by any government agencies.

Combines Features

In essence, the 24-hr. passive communication concept combines many of the desirable features ascribed to a 24-hr. active system such as the Army Project Advent and National Aeronautics and Space Administration's Project Syncom and the various passive or reflective systems, such as NASA's Projects Echo and Rebound. Like the active 24-hr. systems, it would involve a satellite in a 24-sidereal hr., circular, nominally equatorial orbit. The satellite will be in a 24-hr. orbit when it is 22,300 mi. above the equator, so its period of rotation will equal that of the earth. Desirable combined features for the proposed system would then include:

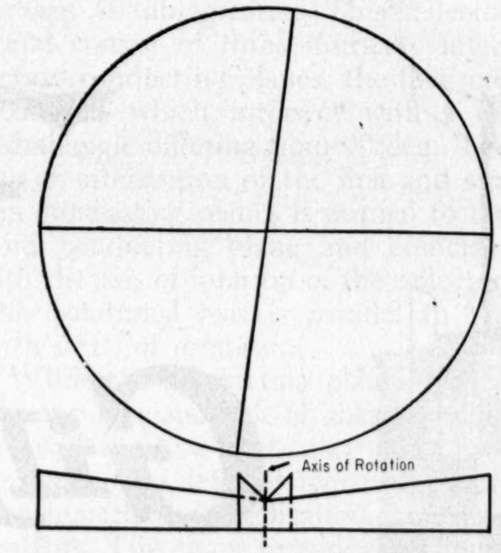
- **Fewer satellites**—Only a single satellite in the 24-hr. equatorial orbit could relay communications between continents. Levenson arbitrarily suggests placing the satellite over the Atlantic so that it relays between two ground stations, at 45 deg. north latitude separated by 70 deg. of longitude; one of which might be located in New England and the other in France.
- **Reliability**—Since the satellite will be a simple reflecting relay and not contain any active parts, it could be expected to have extremely long, reliable lifetime.
- **Continuous operation** — Communications could be carried out continuously because the relay would be in uninterrupted view to two ground stations.
- **Simplified ground station** requirements—Precise tracking requirements and a multiplicity of stations which would be required for a low-altitude active satellite system, whose positions with respect to any points on the earth would be constantly changing, would be unnecessary.
- **Reasonable capacity**—System would be capable of relaying large number of equivalent television bandwidth channels.

Central point in Levenson's concept is whether the passive reflectors can provide sufficient gain to overcome the large cumulative power loss in the lengthy communication paths from transmitting and receiving stations to the satellite.

Levenson calculates that this path length is 24,200 stat. mi. for the locations of transmitting and receiving he selected.

His detailed calculations, only a summary of which could be presented, indicate, he says, that one of two proposed reflector types would enable each television channel to be transmitted between continents with no more power than is currently used for some local television broadcasting.

Both reflector types suggested by Levenson are bistatic; that is, when illuminated by radiation from one direction they will illuminate principally in another direction.



REFLECTOR of type suggested for use in passive 24-hr. communications satellite proposed at recent aerospace symposium is shown above. This shape will provide maximum effective scattering cross section for specific maximum dimension and minimum weight for this cross section.

Summarizing his calculations, for one of two reflector types, Levenson says that each audio channel with an information bandwidth of 5,000 cps. may be transmitted between continents with 50 watts of average power—which, he points out, is less than the power of most AM radio stations with comparable information bandwidths. Each 5-mc. bandwidth television channel similarly might be transmitted between continents with 50 kilowatts, Levenson says. He concludes that one megawatt of average power is capable of transmitting a bandwidth of 100 mc., sufficient for 20 television channels.

These calculations were based on a maximum satellite reflector radius of 50 ft. and maximum effective aperture of the reflector equivalent to a flat plate of 394 sq. ft. area. Frequency employed is in S-band (10 cm.). Ground station antennas were assumed to have radii of 150 ft., receiver noise temperature of 100K. Receiver signal-to-noise ratios of 20 db. after allowance for antenna, reflector and tracking losses were also assumed. Communications from one station to the other would require about 10 milliwatts average power per cycle of bandwidth.

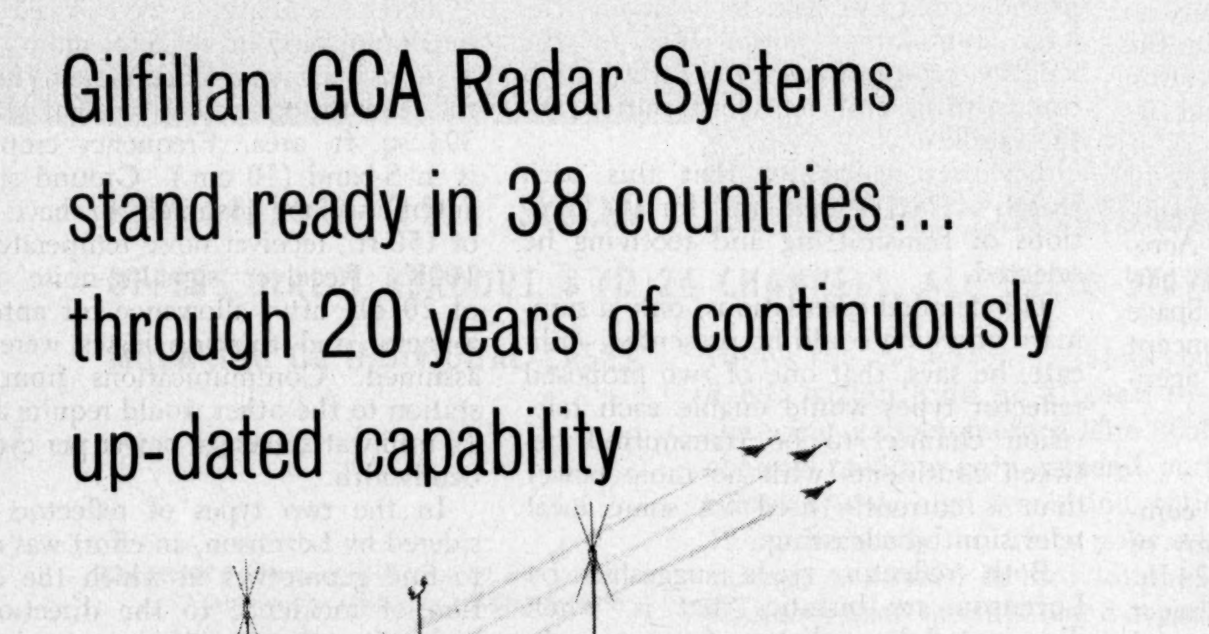
In the two types of reflectors considered by Levenson, an effort was made to find geometries in which the direction of incidence to the direction of high-gain reflection appears invariant to observers on earth for any angular rate of rotation of the reflector. In the first type, Levenson says, the relationship between the directions of incidence and high-gain reflection is independent of the attitude of the reflector about any axis.

In the second reflector type, this relationship between incidence and high-gain reflection is independent of the attitude of the reflector about an axis parallel to the spin axis of the earth.

To satisfy system constraints, reflectors of the first type are such that directions of maximum reflection form the focus of directions making a constant given angle with the incident direction, according to Levenson. Reflection pattern of these reflectors, he points out, appears as a thin ring when mapped on a sphere centered at the reflector. The incident direction will then appear on the sphere as the center of the ring. He says there are no strong reflections either inside or outside the ring. The reflection pattern of a corner reflector,

TODAY

Gilfillan GCA Radar Systems
stand ready in 38 countries…
through 20 years of continuously
up-dated capability



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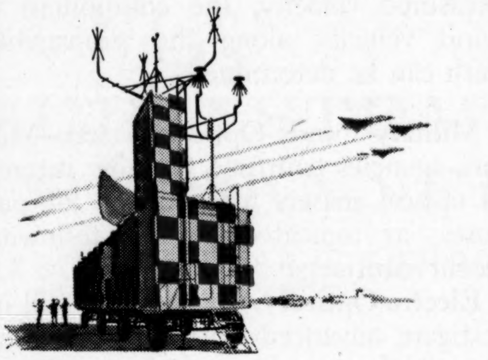

Gilfillan GCA is the only radar equipment in the USAF inventory that has not become obsolete since 1950. The $250,000,000 investment has been protected by foresighted design allowing progressive field modifications providing a 400% increase in radar coverage... bringing the 1950 GCA Radar up to 1960-70 performance capability.

1942	Gilfillan develops (with Radiation Lab., M.I.T.) the first Ground Control Approach (GCA) Navigation Aid radar
1943-44	... produces and delivers GCA, the largest World War II radar (22 tons) at lowest cost and ahead of schedule
1946-47	... develops 3-dimensional Azel radar display reducing operators from 5 to 2
1948-50	... develops air-transportable AN/CPN-4 GCA radar for Berlin Airlift and the Korean War
1950-52	... produces 300 AN/CPN-4's as standard GCA radar equipment for USAF, USN, USMC, U.S. Army and 38 countries in the free world
1953-54	... develops and produces Quadradar as lightweight one-man GCA for military and civil air bases in 24 nations
1955-57	... completes development of Automatic GCA providing automatic approach control to 6 aircraft simultaneously
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1959	... develops 3D Radar with longer range, greater accuracy, higher data rate than any previous 3D Radar development
1959-60	... produces AN/TPN-8 lightweight tactical GCA for U.S. Marine Corps
1960	... up-dates operational GCA equipments, increasing radar altitude coverage from 12,000 to 42,000 feet and extending range coverage from 30 to 60 nautical miles
1960	... develops Mobile Air Traffic Control radar for Marine Corps and Air Force
1961	In these and classified fields, Gilfillan continues as prime contractor to all U.S. Military Agencies—in research, design, development, production and continuous field support

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LOS ANGELES

mapped on this sphere would appear as a solid circular region which includes the area of the thin ring and the area inside of it. Since maximum gain of a reflector is inversely proportional to the solid angle of the reflection pattern, reflectors of this type would provide greater maximum gain in desired direction than would conventional corner reflectors.

Example of Reflector

To illustrate this type of reflector, Levenson selected an array approach. This example would consist of several units each having desired properties over a wide although limited solid angle. With a sufficient number of elements the reflector can have desired properties for any incident direction. Its bandwidth would be limited by the bandwidth of the antenna elements.

Each unit, Levenson explains, consists of a plane array and a conical array of antenna elements. The receiving elements of the plane array would be spaced to avoid undesirably high side lobes. A rectangular array with one-half wavelength spacing between adjacent elements is an example.

The elements of the conical array are situated on the surface of a circular cone whose axis is normal to the plane of the plane array. Elements of the conical array would have to be properly spaced in relation to the elements of the plane array, and each receiving element in the plane array would be connected through a transmission line to its dual radiating element in the conical array.

Second Type

Reflectors of the second type are capable of higher gain than the first type, Levenson says. Gain compared with a corner reflector, he indicates, is perhaps 50 db. greater. This reflector would consist of three mutually intersecting conducting planes, the first and second of which intersect with a dihedral angle differing from 90 deg. The line of intersection of the first and second conducting planes is normal to the third conducting plane and coincides with the axis of rotation of the reflector. This rotational axis is parallel to the earth's axis of rotation.

While the conducting planes can be any one of a number of shapes within a broad limit, a particular shape was devised from a detailed aperture analysis for a hypothetical application, Levenson explains. This shape provides maximum effective scattering cross section in the desired direction for a given maximum dimension and a minimum weight for the cross section.

The direction of propagation of radiation from it will be independent of the attitude of the reflector about its axis of rotation.

FILTER CENTER

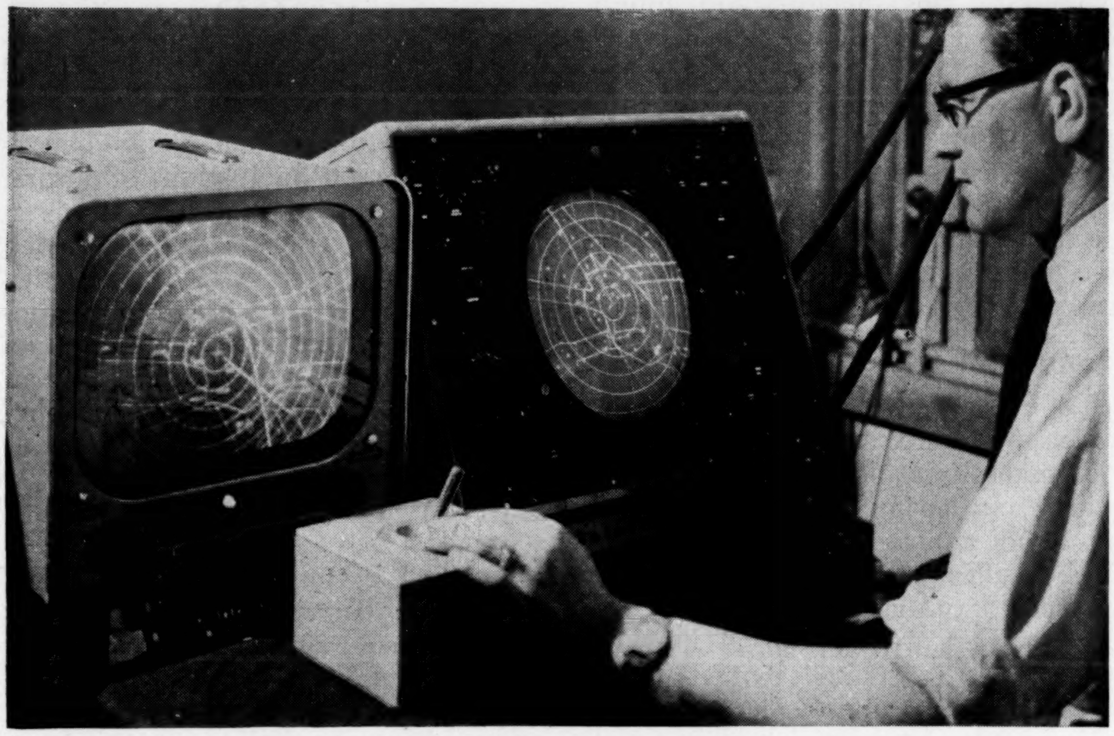
► **NBS Reports Auroral Tests**—The 6- to 10-sec. period fluctuations of auroral intensity is attributed to fluctuations in the E-region of the ionosphere, which in turn are closely related to earth's magnetic field pulsations and ionospheric absorption of cosmic noise, according to scientists at National Bureau of Standards. Investigation of the phenomenon was carried out by NBS Boulder (Colorado) Laboratories and the University of Alaska.

► **Improved Battery for Space Vehicles**—Silver-zinc battery, near final stages of development at Delco-Remy, is expected to deliver eight to 10 times the power per unit weight of nickel-cadmium batteries now in use and to have a continuous use lifetime of 1½ years, company reports. Battery will deliver 28 v.d.c. Development is sponsored by Air Force Systems Command.

► **Infrared Study Lags Schedule**—Background infrared and ultraviolet measurement study, to be conducted by Naval Ordnance Test Station, China Lake, Calif., with the aid of high-altitude rockets simulating the attitudes and altitudes of warning satellites, probably will not be able to adhere to the accelerated schedule initially outlined for it (AW July 17, p. 77). Project is called TABSTONE (Target and Background Signal-to-Noise Evaluation).

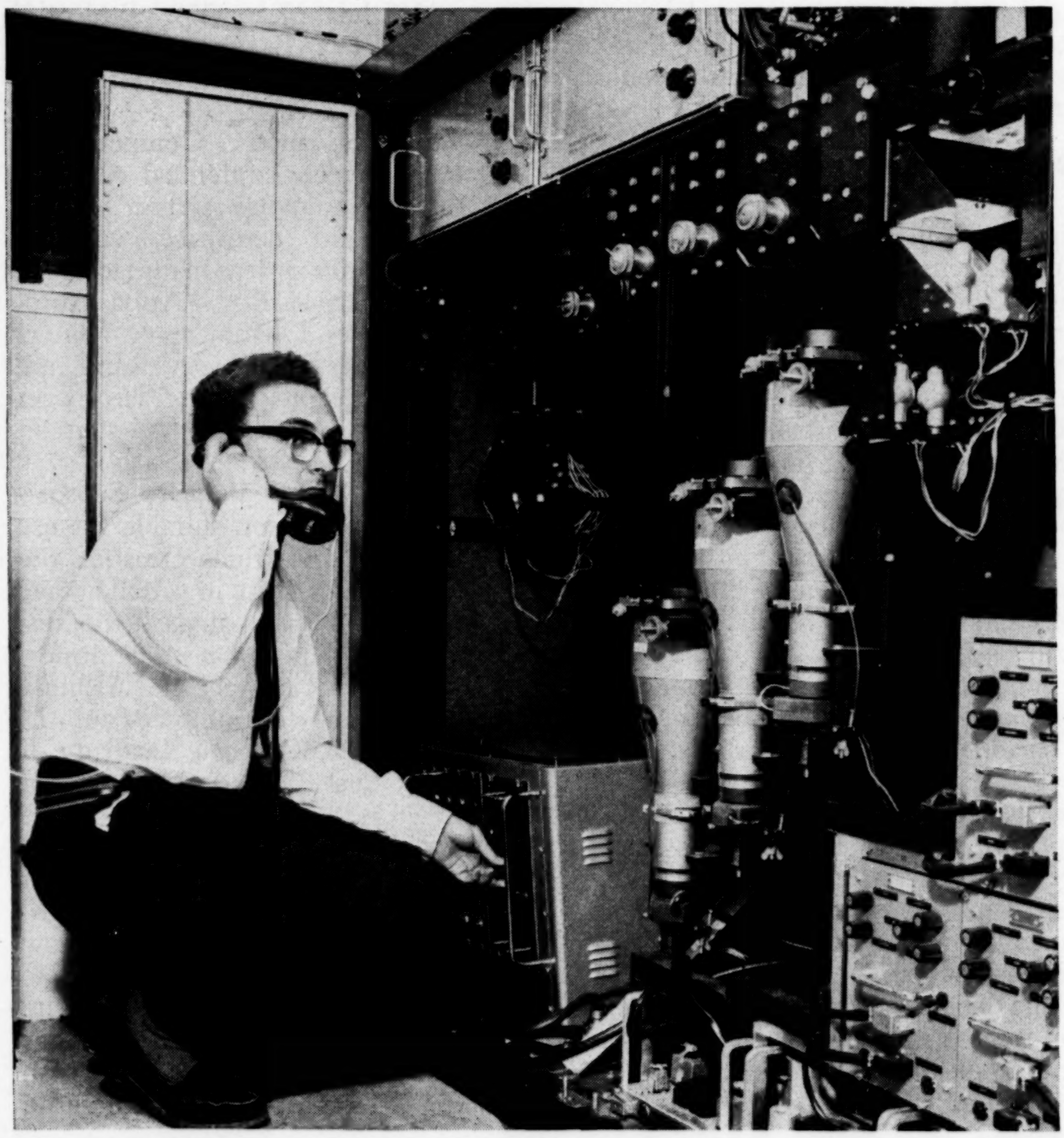
► **Apollo Guidance Competition**—Watch for fiercely contended competition for the guidance system of the manned Apollo aerospace vehicles. Leading guidance system manufacturers, including American Bosch Arma, Autonetics, Hughes, Minneapolis-Honeywell, Nortronics and Sperry Rand, are expected to devote intense efforts in preparation of proposals.

► **New Type Wind Velocity Sensor**—A wind velocity sensor, suitable for use at remote locations, which measures the doppler frequency shift in a radio wave that is reflected from an acoustic disturbance propagating in the atmosphere, was reported at the Military Electronics Convention by Paul L. Smith, Jr. of the Carnegie Institute of Technology and Richard W. Fetter of the Midwest Research Institute. The new type sensor, originally developed to provide an accurate airspeed indicator for helicopters, generates a short, high-intensity acoustic pulse in a narrow beam from a paraboloidal reflector. As the acoustic burst moves away from the source, it is tracked by a doppler radar which measures its velocity. By subtracting velocity of sound from the



British Traffic Identification System

Royal Air Force has completed a series of tests to integrate automatic triangulation direction finding equipment with air traffic control radars in an effort to eliminate military congestion on British airways. System was designed by Standard Telephones & Cables, a division of ITT, and provides instantaneous identification and location of a radar blip, without the need for additional equipment in the aircraft. Experimental triangulation unit at London Airport (above) uses standard air traffic control radar console at right, and TV monitor screen at left. Joystick control moves dot simultaneously on both screens; operator marks intersection of two lines (on TV monitor) for aircraft fix. Lines follow direction of voice transmissions from aircraft and control tower. Photo below shows arrangement of cathode ray tubes in picture synthesizer unit of PVT-2 system; tubes display line traces for direction finding. Bearings are combined optically with map information to be viewed on TV camera connected with closed-circuit link.



measured velocity, the component of wind velocity along the propagation path can be determined.

▶ **Military Funds Optical Masers**—Military agencies continue to show interest in optical masers for a variety of purposes, as indicated by the following recent contracts:

- **Electro-Optical Systems, Inc.,** will investigate advanced optical maser components for use in optical surveillance systems under a $94,700 contract from Rome Air Development Center. Goals of this effort will involve new techniques and materials to be used in optical maser amplifiers, oscillators and coherent detectors. This is company's second contract in optical masers, the first being from National Aeronautics and Space Administration for an optical maser beacon.
- **Technical Research Group, Inc.,** Syosset, N. Y., will continue its broad research in optical masers, techniques and materials under a $.25-million follow-on to its Air Force Office of Scientific Research-administered Advance Research Projects Agency program. This represents another reduction in funding level from the first year's $1 million, last year's $.75 million for the same program (AW Dec. 14, 1959, p. 87).
- **Hughes Aircraft Co.** and Technical Research Group, Inc., each will conduct separate studies of a range finder for helicopters and tanks using an optical maser under parallel contracts from Army's Frankfort Arsenal (AW Apr. 24, p. 81).

▶ **Signed on the Dotted Line**—Major contract awards recently announced by avionics companies include the following:

- **Babcock Electronics Corp.,** Costa Mesa, Calif., $480,000 from Martin Co. for airborne range safety receivers and support equipment for the Lacrosse missile.
- **Philco Corp.,** Philadelphia, $10.5 million from Air Force for furnishing and installation of teletypewriter equipment to improve USAF's global communication system.
- **Aircraft Armaments, Inc.,** Cockeysville, Md., $750,000 award from Bureau of Naval Weapons for design and manufacture of performance monitors for Terrier missile fire control radars. Company also reports a $2.6-million Army contract for training equipment to be used with Sergeant missile system.
- **Budd Electronics,** $3-million contract from Rome Air Materiel Area for modification of gap filler radars now in use by North American Air Defense Command.
- **Motorola,** Military Electronics Division, Scottsdale, Ariz., two awards totaling $477,550 from Philco Corp. for precision satellite tracking receivers.

SUBSYSTEMS DEVELOPMENT FOR MANNED SPACE VEHICLES

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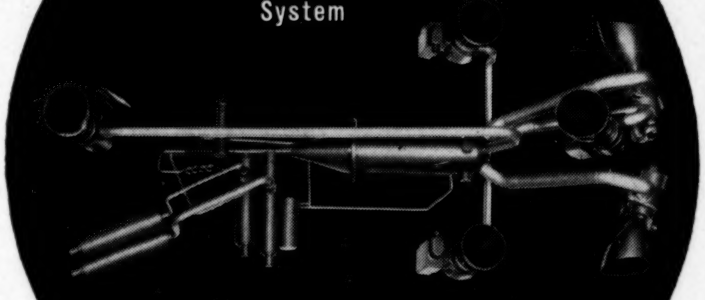

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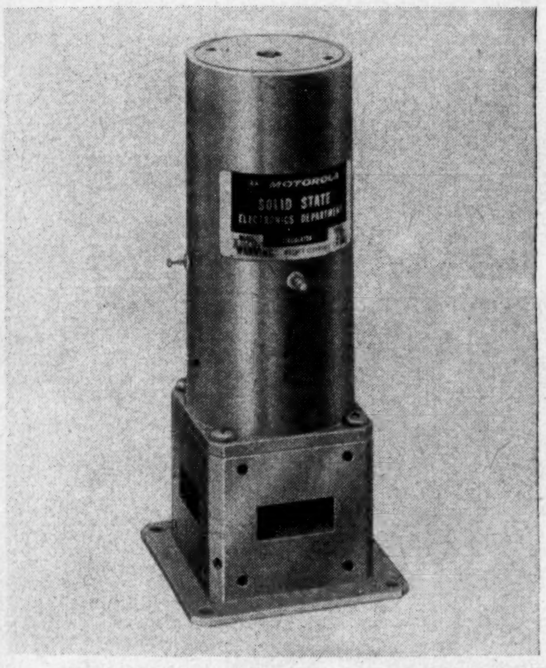
THE COLUMBUS DIVISION OF NORTH AMERICAN AVIATION
Columbus, Ohio

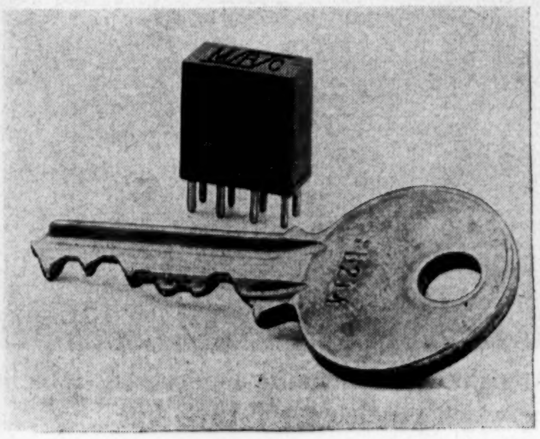
NEW AVIONIC PRODUCTS

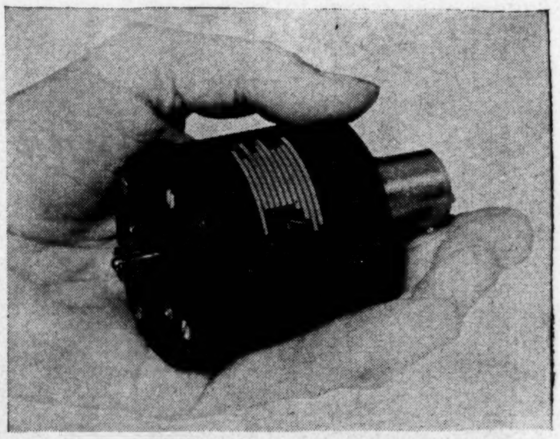
• **X-band turnstile switch,** Model XS04, based on turnstile circulator, is four port device in which signal at first port is transmitted to second port with remaining ports decoupled, etc. Switch consists of two crossed rectangular waveguides with 45 deg. Faraday rotator in shorted circular waveguide section orthogonal to broad wall of rectangular guides. Direction of circulation reverses with reversal of magnetic field applied to Faraday rotator. Manufacturer: Motorola, Inc., Solid State Electronics Department, P.O. Box 5409, Phoenix, Ariz.



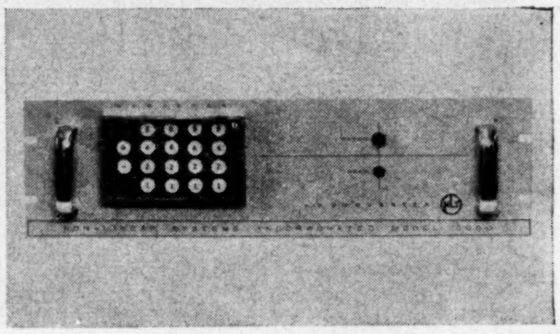
• **Micro rectifiers,** rated in excess of 600 p.i.v, 250 m.a. average rectified current, 5 amp. surge. Units are 750 mils long, 30 mils diameter and can be used in ambients of more than 200C. Manufacturer: MicroSemiconductor Corp., 11250 Playa Ct., Culver City, Calif.

• **Micro magnetic shift registers** which operate at shift rates up to 250 kc. and provide 5-volt flat-topped output pulses at one-zero ratios of better than 8 to 1 are available in 1/16 cu. in. per bit packages. Register modules weigh 2 grams. Units can be used for parallel to serial, serial to parallel conversion of information, buffer storage and counting. Small quantities can be obtained in 30 to 45 days at prices from $12 to $16. Manufacturer: Magnetics Research Co., Inc., 179 Westmoreland Ave., White Plains, N.Y.





• **Servo actuator, Series 3170,** a clutch type actuator that weighs less than 1 lb. and may be used where precision is needed with relatively little power. Actuator provides torque range of from 1 to 70 lb.-in. Corresponding speed range from 285 to 4.6 rpm. is attained by varying gear reduction package. Applications include valve actuation, rocket nozzle control and use in optical and infrared tracking and computers. Manufacturer: Lear, Inc., Electro-Mechanical Div., 110 Ionia Ave., N.W., Grand Rapids 2, Mich.



• **Analog-to-digital converter,** NLS Model 5,000, makes 15,000 complete voltage readings per second with overall accuracy of 0.01%, plus one digit. Typical input impedance for the unit is 6.25 kilohms for the plus or minus 10 volt range. Self-contained in rack mountable packages the model measures 5½ in. in height, 19 in. wide and 12½ in. in depth, weighs 26 lb. It is available from stock at $6,950. Manufacturer: Non-Linear Systems, Inc., Box 728, Del Mar, Calif.

• **Microwave polarimeter,** capable of determining polarization characteristics of S and X band radio frequencies (from 2 kmc. to 12 kmc.). Meter can determine left or right hand sense of rotation of circularly or elliptically polarized carriers. Each unit will cover range of 20% either side of center frequency and indications are unaffected by type or percentage of modulation. Unit is self-contained, capable of airborne operation, and is built to military specifications. Price is less than $20,000 according to the manufacturer, Dayton Electronic Products Co. (DEPCO), 915 Webster St., Dayton 4, Ohio.

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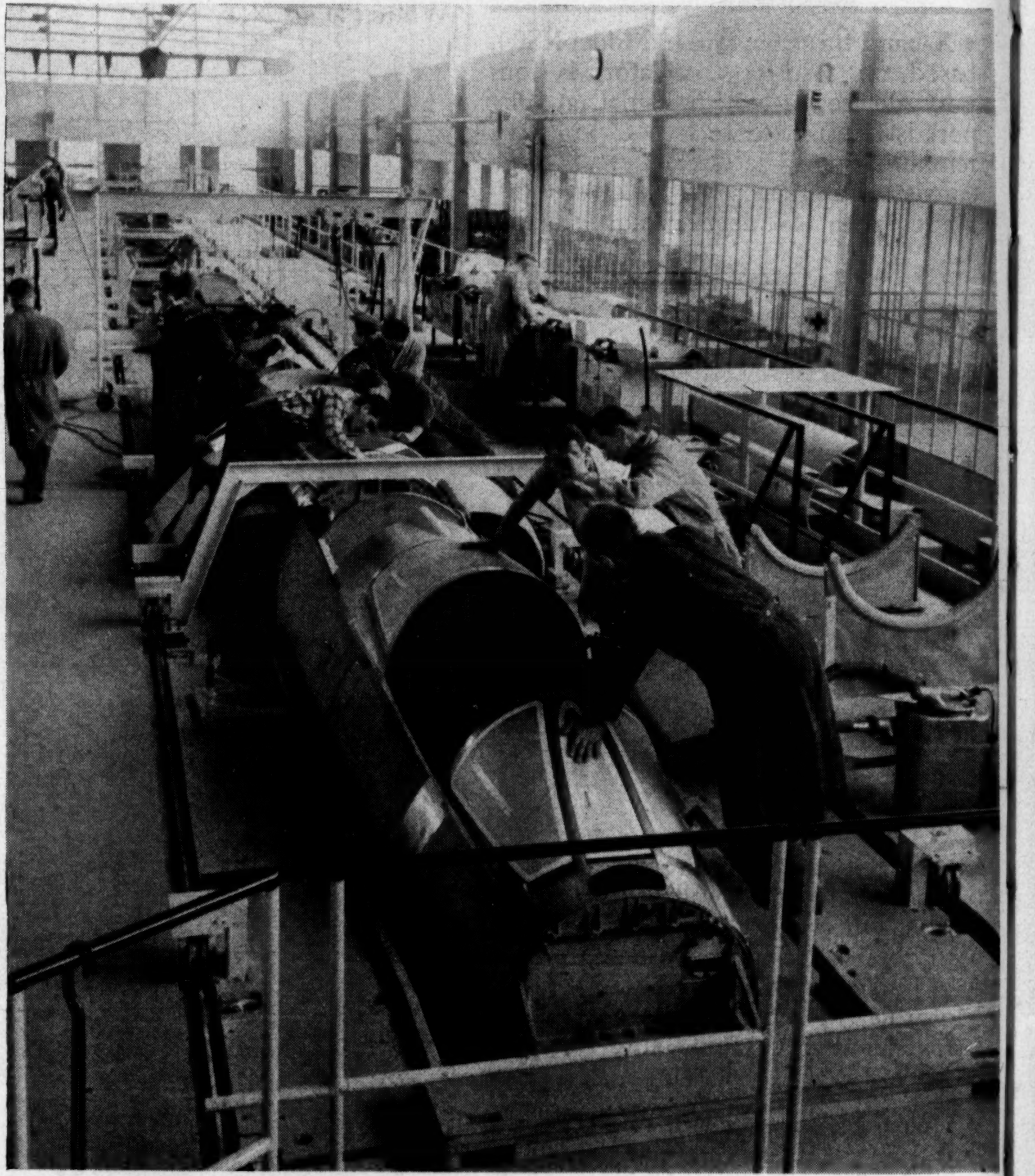
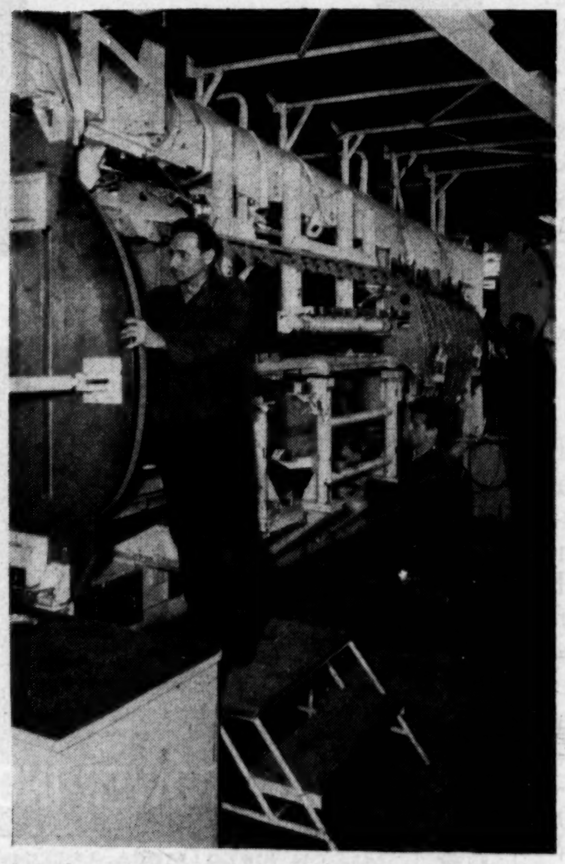
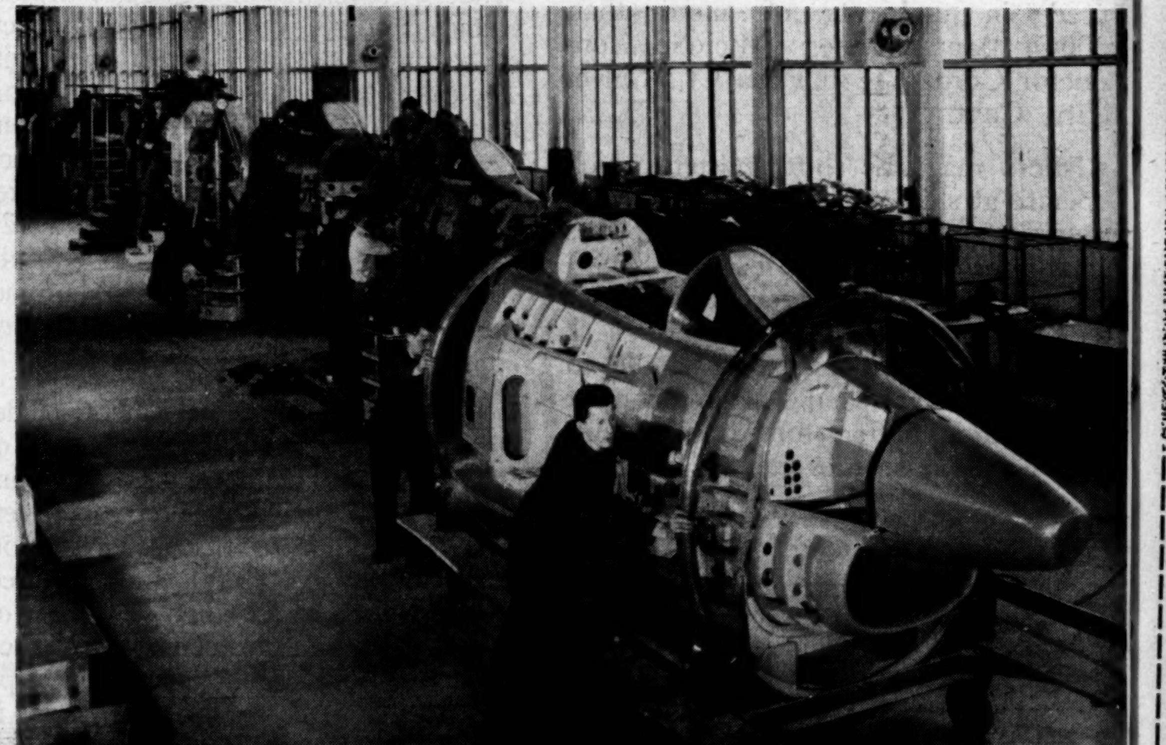
West Germans Build Lockheed F-104Gs, G.91 Under License

First of 949 Lockheed F-104G all-weather fighters scheduled to be produced under license in Europe is beginning its flight test evaluation trials. The aircraft was constructed by the German Southern Group composed of Dornier, Heinkel, Siebel and Messerschmitt, with the latter firm carrying out the final assembly and flight test from its machining plant. First F-104G rolled out recently and delivery to the West German air force is scheduled within the near future. The Southern Group is to build a total of 210 airframes, with other firms in Germany, Belgium, Italy and The Netherlands constructing the remainder of the European consortium's 949 F-104Gs. All are scheduled for completion by late 1964 or early 1965. Of the total, the West German air force will receive 604, Italy 125, The Netherlands 120 and Belgium 100. First of 230 Fiat G.91 R/3 close-support fighters to be built under license in Germany for the air force also was rolled out recently, and flight tests are under way by Dornier. Dornier's production partners in the project are Messerschmitt and Heinkel.



West German F-104G is assembled at Messerschmitt's Augsburg plant near Munich.





Augsburg workmen install components in the center fuselage section of an F-104G at left. At right, Messerschmitt employes assemble forward fuselage sections of a license-built Fiat G.91 close-support fighter on a production line which parallels the F-104G line.

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PRODUCTION BRIEFING

Westinghouse Electric Corp. has received a Navy contract for development and production of a 400-cycle turbine-generator complete with switchgear to provide power for the Typhon automated missile system.

First temperature control units for storable liquid propellants which will power USAF Titan II ICBMs have been delivered by Hamilton Standard Division of United Aircraft Corp. Skid-mounted unit, installed next to the fuel storage vessel, will circulate glycol-water to a heat exchanger on the vessel. A 34-ton refrigeration system and 90-kw. electric heater will cool or warm transfer liquid as required. Temperature sensor and control automatically operates a three-way valve, diverting glycol-water to either heating or cooling system.

Melpar, Inc., of Falls Church, Va., Westinghouse Air Brake Co. subsidiary, will provide seven GAM-83A/B Bullpup missile trainers for Air Force Systems Command's Aeronautical Systems Division under a $957,940 contract.

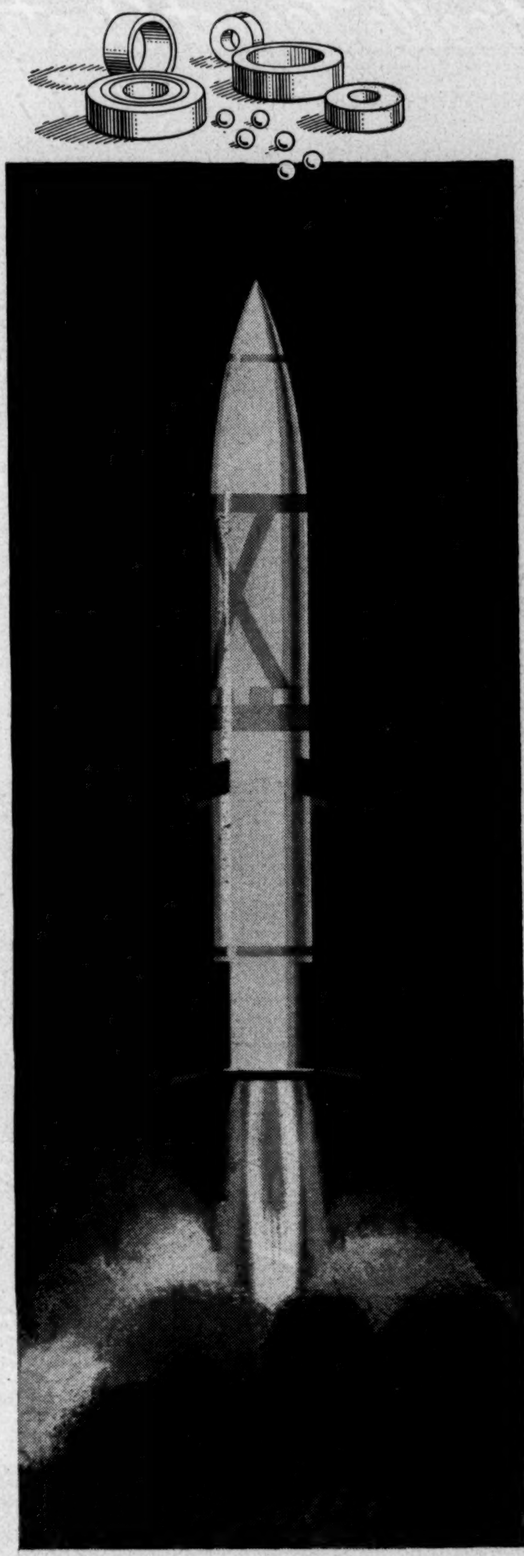
The Hayes Corp., Birmingham, Ala., has received a $1,750,000 Air Force contract for modification and overhaul of Curtis-Wright propeller assemblies and components for B-50 and C-124 aircraft.

American Airmotive Corp. of Miami, Fla., will perform maintenance on C-54 aircraft under a $3,640,000 contract from USAF.

NASA's Marshall Space Flight Center has awarded a $3,611,000 contract to Rust Engineering Co. of Birmingham, Ala., for construction of a 117,-800 sq. ft. addition to the center's quality division checkout building at Huntsville, Ala. Space will be used for part of the center's Saturn vehicle checkout operations. Contract also covers instrumentation for checkout stations and special power sources and distribution cabling.

Washington Scientific Industries, Inc., Minneapolis, Minn., will supply servo control mechanisms primarily designed for use aboard Boeing 707s under a contract in excess of $50,000.

Northrop Corp.'s Nortronics Division has been awarded Air Force contracts to provide penetration rocket launchers for SAC B-52H missile platform bombers. Launchers and associated electronics controls will be designed, developed and produced at Nortronics facilities in Anaheim, Calif.



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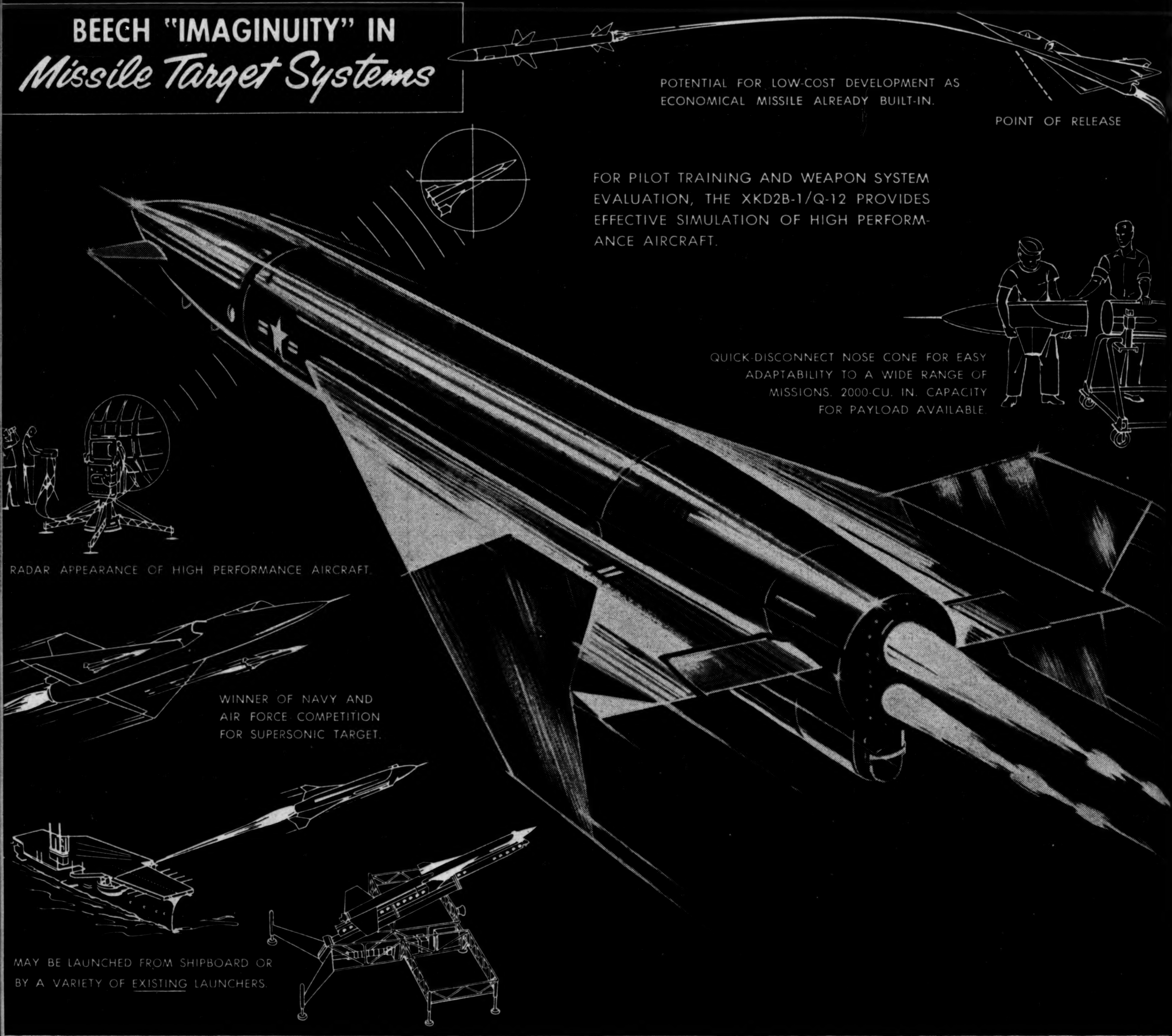
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Mach 2 target system developed by Beech also has promising potential as economical missile system

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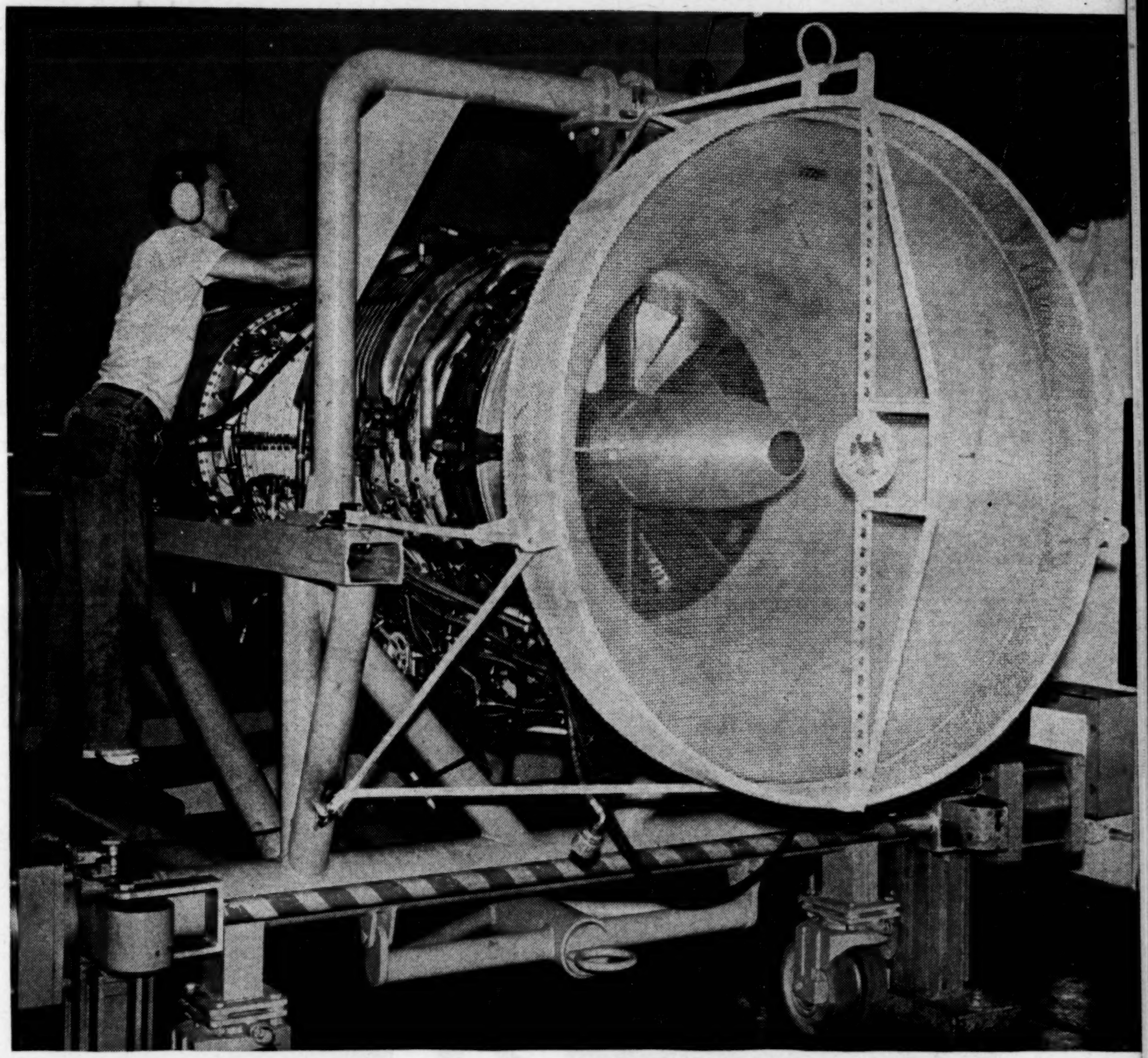
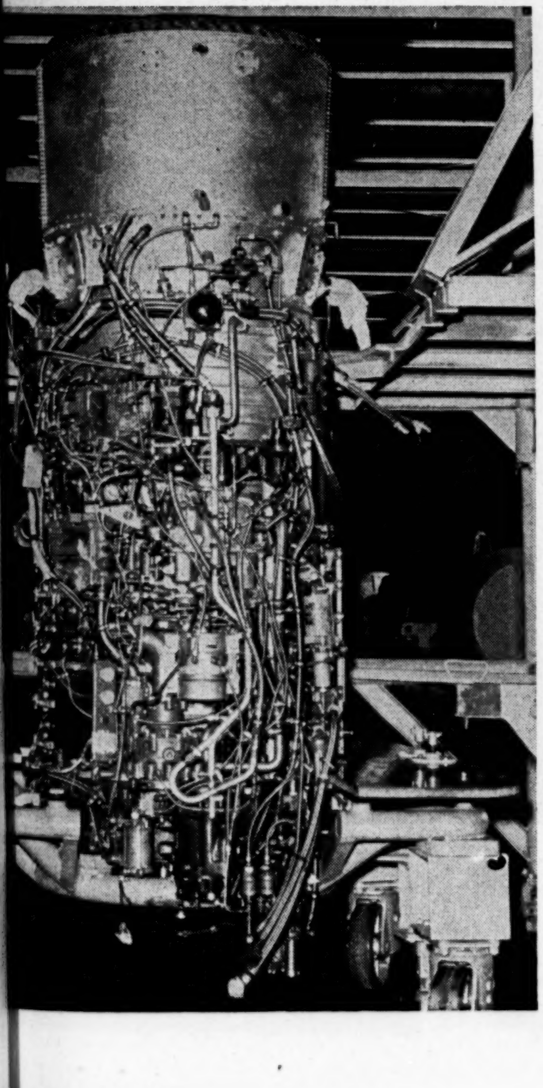
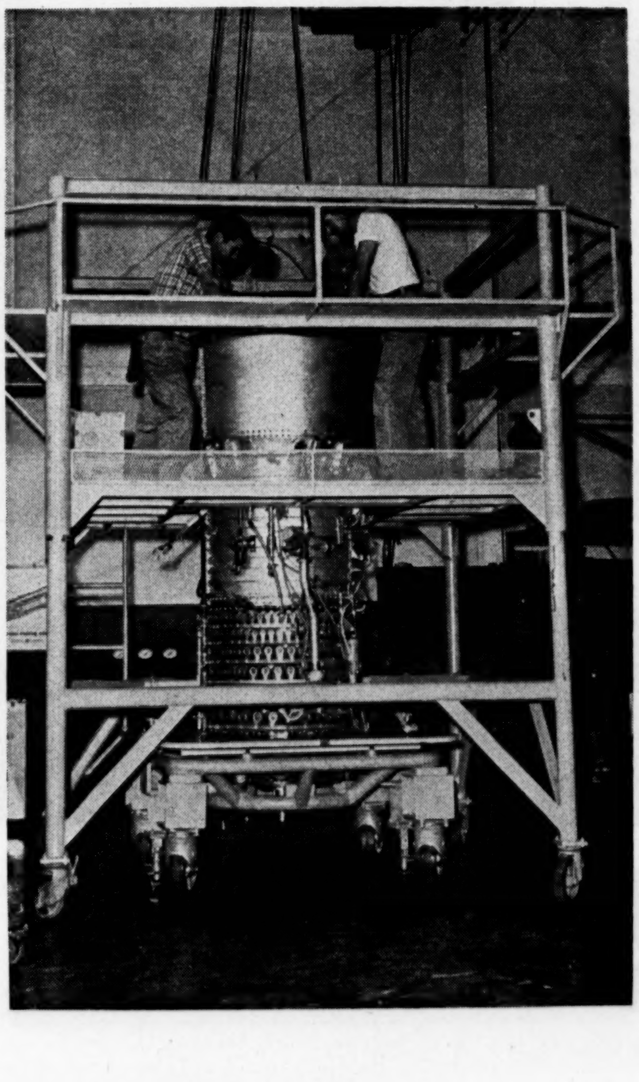
Special Stands Speed Overhaul Of Air Force J79 Engines

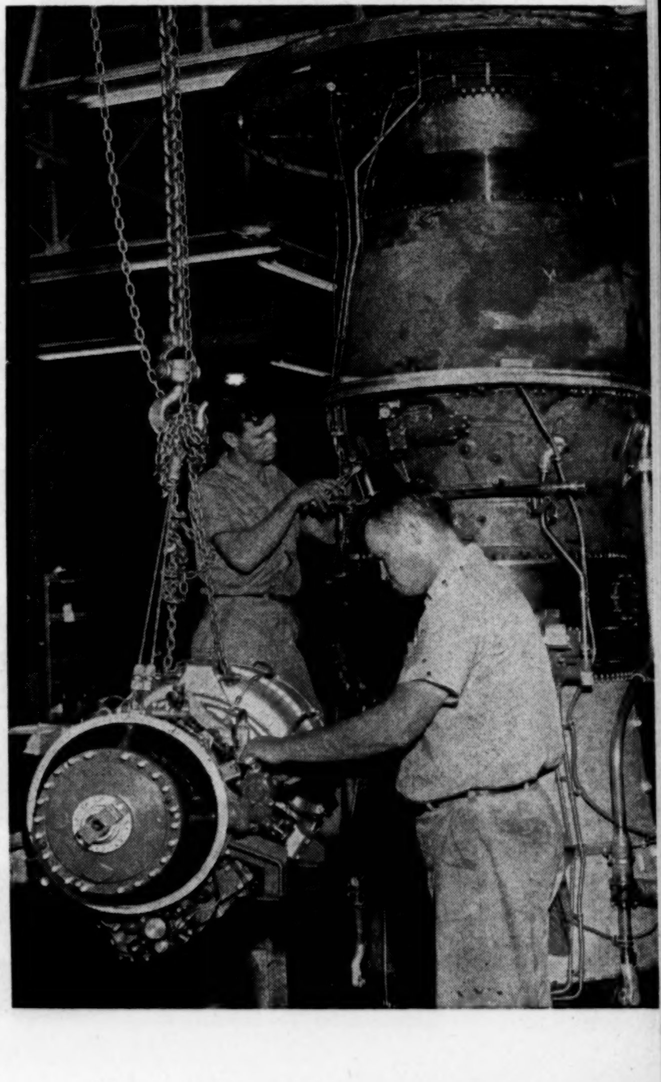
Special handling stands used by Southwest Airmotive Corp. to handle Air Force J79 engines being overhauled under contract totaling approximately $400,000 have inner sections which fold back (below, left) to permit entry or removal of J79 mounted on dolly. Stand, which is 10 ft. high and 8 ft. wide, can handle other types of turbojet engines with minor modifications. Stand, (below, center) provides working height of four to eight feet all around engine. Working platform is attached to a four-inch pipe sleeve over the three-inch verticle piping and is raised and lowered using an overhead hoist. Designed and built by SAC employes, the workstand is similar to those used by USAF, but differs in that it has an adjustable work platform and castering ability, providing ready mobility. Engines can be wheeled into the workstand or the stand can be positioned around the engine. Turbine engines currently being overhauled by SAC at its jet engine overhaul facility near Amon Carter Field vary in size (below, right) from Lycoming T-53 in foreground to Pratt & Whitney JT4 (J75) in rear.



Positioned in test cell ready for running after overhaul is J79 engine for B-58A (above). Overhead junction box (black area above and right of engine) groups all necessary engine-to-control room connections and is designed so that harnesses for various engine types cannot be inadvertently installed incorrectly. Engine is run with afterburner power. Present contract, which calls for modification of more than 100 J79-GE-5A engines to -5B configuration, is the first of its type received by the company. Southwest Airmotive has overhauled and modified about 10,000 various turbine engines for airlines and the military.







Objective:

The *__right__* *fire and overheat detection device*

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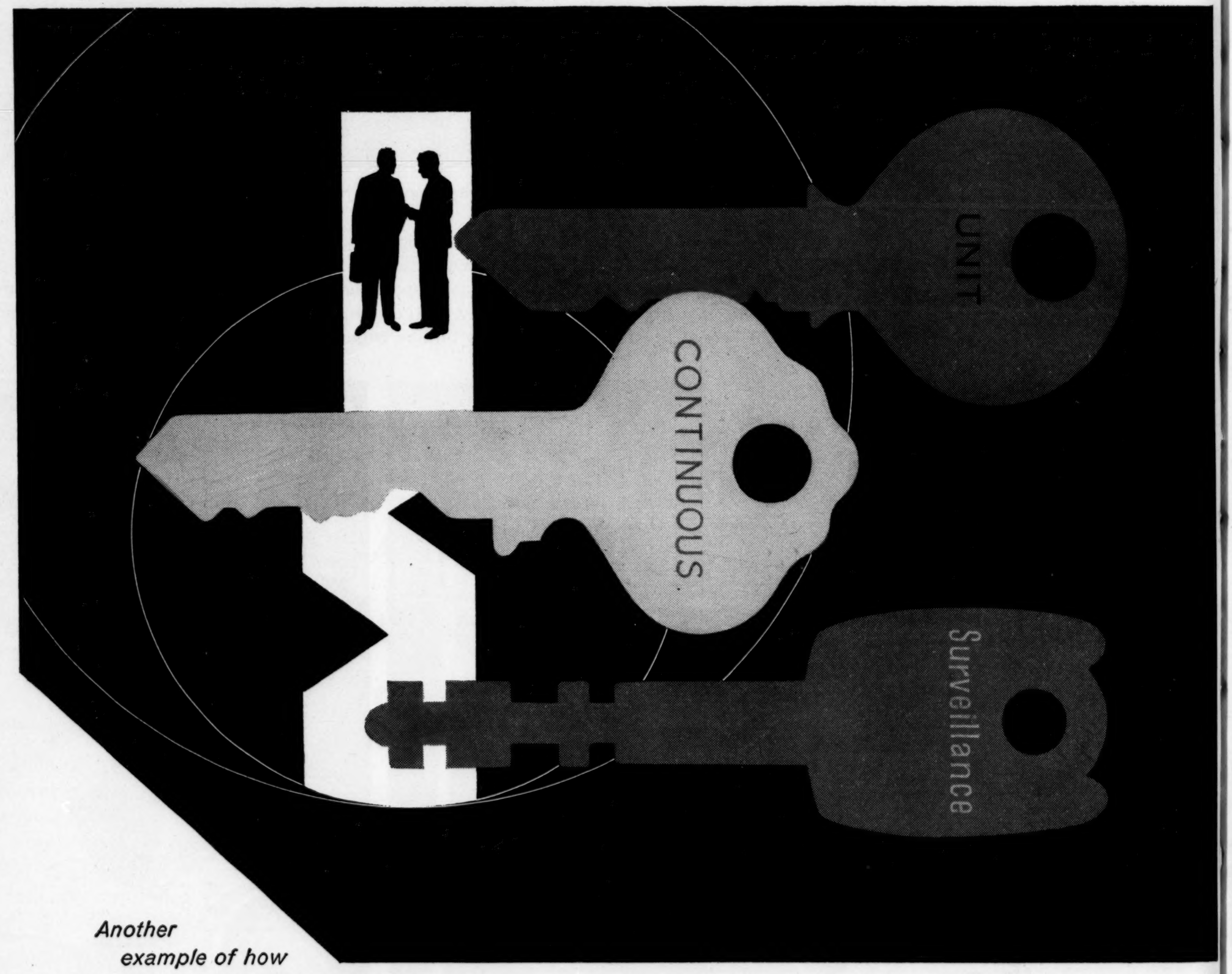

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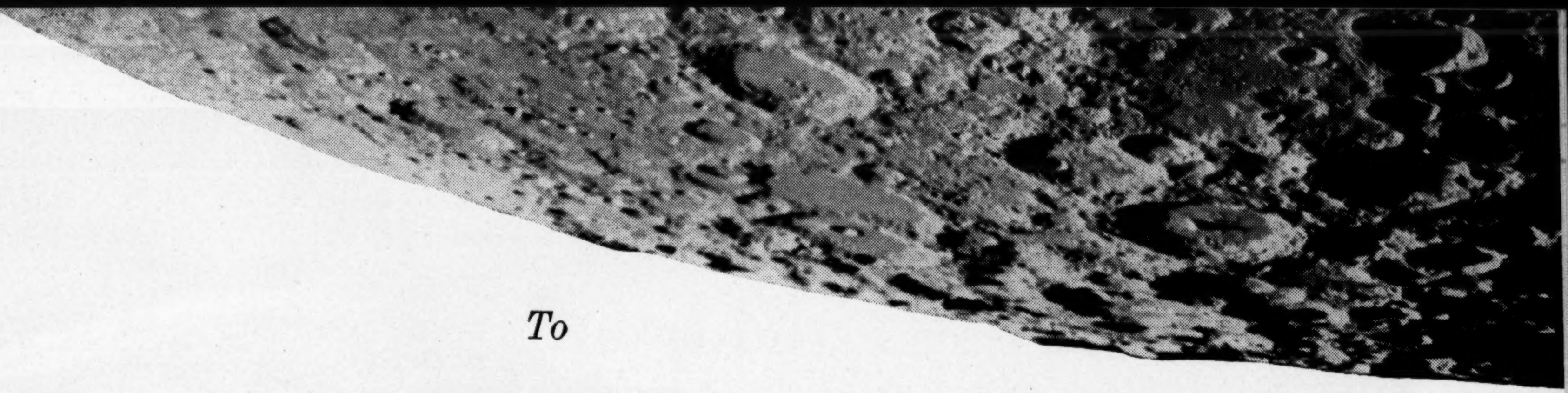

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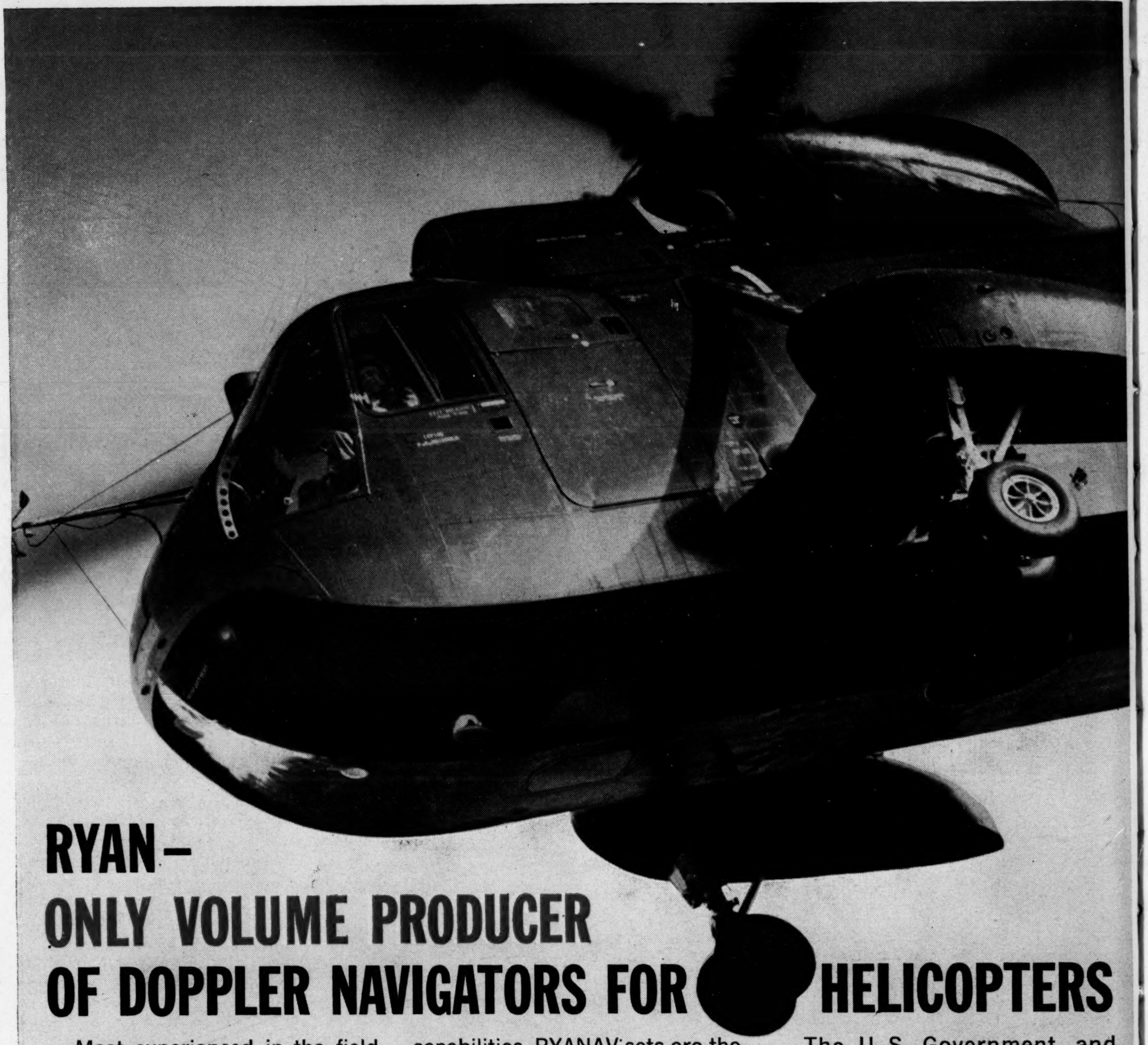

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CAB Accident Investigation Report—Part I:

Deicer Failure Blamed for Learstar Crash

At approximately 0930 Dec. 15, 1958, a Learstar aircraft, N 37500, owned by Johnson and Johnson, Inc., crashed in a wooded area during a snowstorm approximately 5 mi. southwest of Woonsocket, R. I. The five passengers and the two crew members all received fatal injuries.

The Civil Aeronautics Board was notified of this accident on Dec. 15, 1958, and an investigation was immediately initiated in accordance with the authority of Title VII of the Civil Aeronautics Act of 1938, as amended, and was continued under the authority of Title VII of the Federal Aviation Act of 1958, as amended. Depositions were taken on this matter commencing Feb. 5, 1959, and the Board issued an accident report on Sept. 11, 1959. In the light of new and pertinent evidence which became evident after the issuance of the original accident report, the Board determined that it would be in the interest of the public to hold a public hearing on this matter which was held commencing June 29, 1960, in Providence, R. I.

The flight was scheduled as a nonstop business trip from Linden Airport, N. J., to Logan Airport in Boston, Mass. The aircraft departed Linden Airport and proceeded in accordance with its instrument clearance. The aircraft was reported over the Hartford VOR at 0913.[1] Approximately 6 min. later the captain advised that the right engine was inoperative, the propeller feathered, and declared an emergency. He indicated that he would continue in accordance with his instrument flight plan to the Logan Airport. The flight was cleared to Boston to maintain 5,000 ft. until another altitude was available. At approximately 0926 the captain advised the Boston Center that he was experiencing a loss of power on the left engine. The aircraft crashed at approximately 0930, 5 mi. southwest of Woonsocket, R. I., and some 35 mi. (approximately 12 min.) southwest of the Logan Airport.

System Restudy Urged

As a result of tests conducted by Pac Aero Engineering Co. (builder of the Learstar) on Learstar N 20L, which disclosed considerable stratification in the air induction system, the Board recommended to the Administrator of the Federal Aviation Agency that the adequacy of the Learstar heat induction system be re-evaluated. Subsequently, additional FAA tests were conducted on the Learstar air induction system, resulting in the issuance of a Federal Aviation Agency Airworthiness Directive on Oct. 7, 1960, restricting Learstar aircraft against operating in known icing conditions until modifications to the carburetor air preheat system have been accomplished.

The Board determines that the probable cause of this accident was the failure of the anti-icing and deicing systems to prevent and remove carburetor ice under the atmospheric conditions encountered.

Learstar N 37500 was one of the three aircraft owned and operated by Johnson and Johnson, and was being operated in accordance with a flight schedule prepared under the supervision of the company's chief pilot. The purpose of the flight was to transport five employes from the Linden Airport, Linden, N. J., to the Logan Airport at Boston, Mass.

The estimated flight time was 1 hr., and departure was scheduled for 0830, Dec. 15, 1958.

N 37500 was last refueled at Fort Lauderdale, Fla., on Friday, Dec. 12, 1958, where 593 gal. were added to bring the total fuel load to 892 gal. of 100-octane gasoline. The 4 hr. flight to Linden, N. J., consumed 452 gal., leaving 440 gal. aboard. The aircraft was not refueled at Linden for the flight to Boston, since 4 hr. of fuel remained at a normal consumption of 110 gal. per hour.

The aircraft was hangared during Saturday and Sunday.

The computed gross weight at takeoff was 20,732 lb., well below the maximum allowable takeoff gross weight of 24,000 lb. The aircraft was loaded within the allowable c.g. limits.

Weather Briefing

Between 0700 and 0730 Monday morning, Dec. 15, Capt. Alex Sable, a regularly employed Johnson and Johnson pilot, was briefed by telephone on en route and terminal weather conditions. The briefing was supplied by the Chief Meteorologist of the National Weather Forecasting Corp., Newark, N. J. The forecast en route and terminal weather conditions, as supplied during this briefing, were as follows: Boston at arrival—ceiling 2,000 ft. overcast, visibility 3 mi. in snow showers, cloud tops at Boston 9,000 ft; Newark—broken clouds based at 2,500 ft. with tops at 4,000 ft; probable light icing in clouds en route; winds at 5,000 ft.—250 deg., 20 kt.; 7,000 ft.—250 deg., 30 kt.; 9,000 ft.—250 deg., 40 kt. During the course of the briefing the meteorologist gave Capt. Sable the 0700 sequence weather for Boston. He stated further that he may have given him the 0700 weather for Providence and others, as well as Newark.

There is a drop line maintained at Linden Airport on Service A Teletype Circuit 8002. This is one of the circuits utilized by the U. S. Weather Bureau for the exchange of operational weather information. It was not possible to determine, however, whether Capt. Sable had inspected the teletype machine data for further information before departure.

The aircraft departed Linden Airport at 0834, and after takeoff commenced an en route climb to Caldwell Intersection under the guidance of Newark radar; the flight was subsequently turned over to the New York Center and routed to Poughkeepsie VOR. A position report was made which indicated that the aircraft was over Poughkeepsie VOR at 0901 at 5,000 ft. After this report, the flight was cleared to contact the Boston Center and the next position report indicated that the aircraft was over Hartford VOR at 0913, estimating Sterling Intersection at 0922.

Crew Message

After passing the Hartford VOR the aircraft proceeded along Victor 167 Airway en route to Sterling Intersection. At approximately 0920, Boston ARTC Center received a message from the crew of N 37500. The recording device at the Boston Center recorded only the outgoing portion of the two-way radio conversations, and that portion read as follows:

"Learstar three seven five hundred, Boston. Roger, we have you estimating Sterling at twenty-two, is that correct? At five thousand. Three seven five hundred, are you reading the Center? Seven five hundred say again your emergency please. Roger three seven five hundred, lost your right engine, and declaring an emergency. Do you wish to proceed to Boston or Providence, sir? Do you want to land at Providence? . . . wish to proceed to Boston. You are cleared to the Boston outer marker, Victor 16 Franklin direct, maintain five thousand and we'll have another altitude for you shortly. Roger three seven five hundred."

The precise time of N 37500 over Sterling is unknown, since the controller did not remember it. He believed, however, that it was at approximately 0922. At approximately 0926, Boston Center transmitted the following message:

"Three seven five hundred, Boston. Three seven five hundred, Boston. You are losing the other engine, is that correct? Roger five hundred, do you wish to go to Providence now or land at North Central perhaps? Roger, three seven five hundred, descend to and maintain four thousand and stand by this frequency. Three seven five hundred, you're cleared to the North Central radio beacon direct course, maintain four thousand and advise when able to pick it up. Three seven five hundred, you wish to land at North Central Airport?[2] Is that correct? I beg your pardon. You still want to come straight into Boston, is that correct? Roger three seven five hundred. Your original clearance is correct. Maintain four thousand, cleared to the Boston ILS outer marker, Victor sixteen, Franklin, direct."

Shortly after this transmission Boston Center asked if the aircraft was over Franklin Intersection and was told that it was

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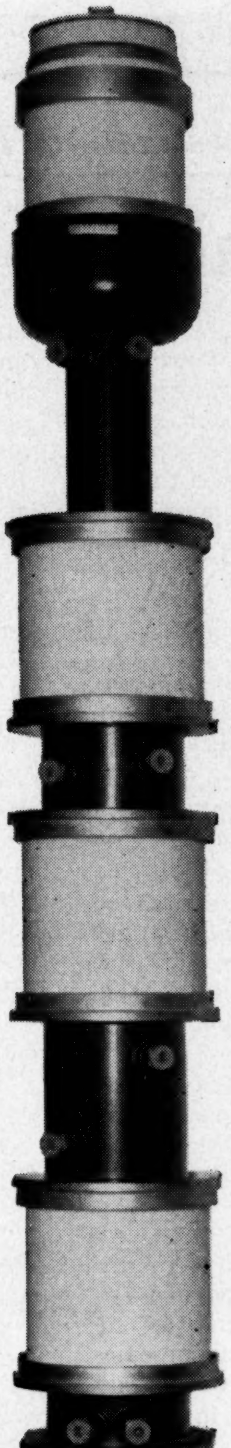
[1] All times herein are eastern standard based on the 24-hr. clock.

[2] The North Central Airport has a private unpublished approach procedure and beacon. The beacon frequency is available on request from the Center.



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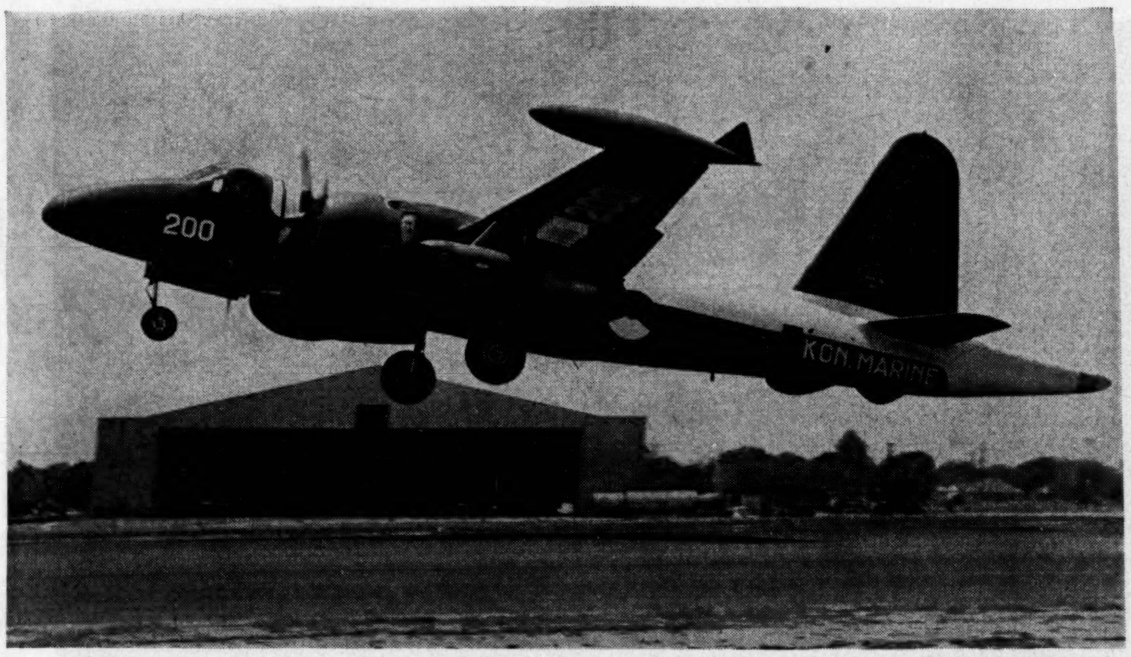

First of Netherlands' P2V-7s Makes Flight

Royal Netherlands Navy—Koninklyke Marine—has ordered 15 Lockheed P2V-7 Neptunes, the first of which is shown making a test flight at Lockheed's Burbank, Calif., factory. Deliveries will begin this month and continue into 1962. Purchase was negotiated with assistance of U. S. State Department and Navy.

coming up on Franklin at 0930.

Instructions were then given N 37500 to contact Boston Approach Control immediately on 126.5 mcs. At 0935, no communication had been received from the aircraft by Boston Approach Control on this frequency and subsequent calls on 120.3 mcs. and 121.5 mcs. failed to elicit any response.

At 1220, the wreckage of N 37500 was located by search aircraft approximately five miles southwest of the city of Woonsocket, Rhode Island.

Structures

The aircraft was found to have struck the ground in a marshy section in a very steep attitude while inverted and the direction of travel at impact was approximately 80 deg. magnetic. Most of the wreckage was confined to an area not much longer than the aircraft. The nose section and cockpit were demolished and the aft section of the fuselage and the empennage came to rest on its left side. The left wing, still attached to the center section, was twisted and deformed and its leading edge was crushed rearward to the main spar. The right wing was relatively intact except for some minor damage. The left fin and rudder, elevator, and horizontal stabilizer were twisted and deformed but remained attached to the fuselage. The right fin and rudder, elevator, and horizontal stabilizer remained attached to the fuselage and were undamaged. Control cable continuity was checked and found to exist on all control surfaces. The trim tabs were all found to be near the neutral position and all control surface hinges moved freely. Examination of control surfaces and trim tabs indicated them to have been operative prior to impact.

The rudder spring tab and the rudder bungee were both checked at the scene and both were found to have been correctly installed and properly adjusted.

The main landing gear, flaps and the tail wheel were all in the up position at impact. There was no evidence of any inflight or ground fire. The passenger cabin area of the fuselage was generally broken up, and the floor and its underlying structure were broken and deformed owing to impact forces.

Two of the passenger seats and the three-place lounge broke free at their attach points at impact.

Because of the severe disintegration of the cockpit area, readings from instruments and the position of controls could not be accurately established.

Examination of the CO_2 fire extinguisher system and the heater fire extinguisher revealed them to be in a charged condition and undamaged.

A cabin hand fire extinguisher was found with damage at the valve area but still charged.

The Janitrol cabin heater was examined and found to be impact damaged but showed no evidence of puncture or having burned through or of any other malfunction.

The surface deicing system was examined and the left wing rubber deicing boots were found to have been destroyed by impact force. The remainder of the surface boots were still attached to their respective components. Examination of the solenoid-operated distributing valves, electric timer, surface control switch, and the pressure lines showed the system to be capable of normal operation; however, it could not be determined if the system was in operation at the time of the crash.

Powerplants

Both engines, WAD Model R-1820-76B, were found attached to their mounts which in turn were still partially attached to their nacelle structure. Both engines were recovered from craters which were filled with water, ice, gasoline, and a layer of foam which had been applied as a fire preventive. The left engine and propeller were completely submerged and not visible until pulled from the hole. The right engine and propeller were also submerged except for the upper third of the firewall and the carburetor duct.

Damage to the engines was primarily to

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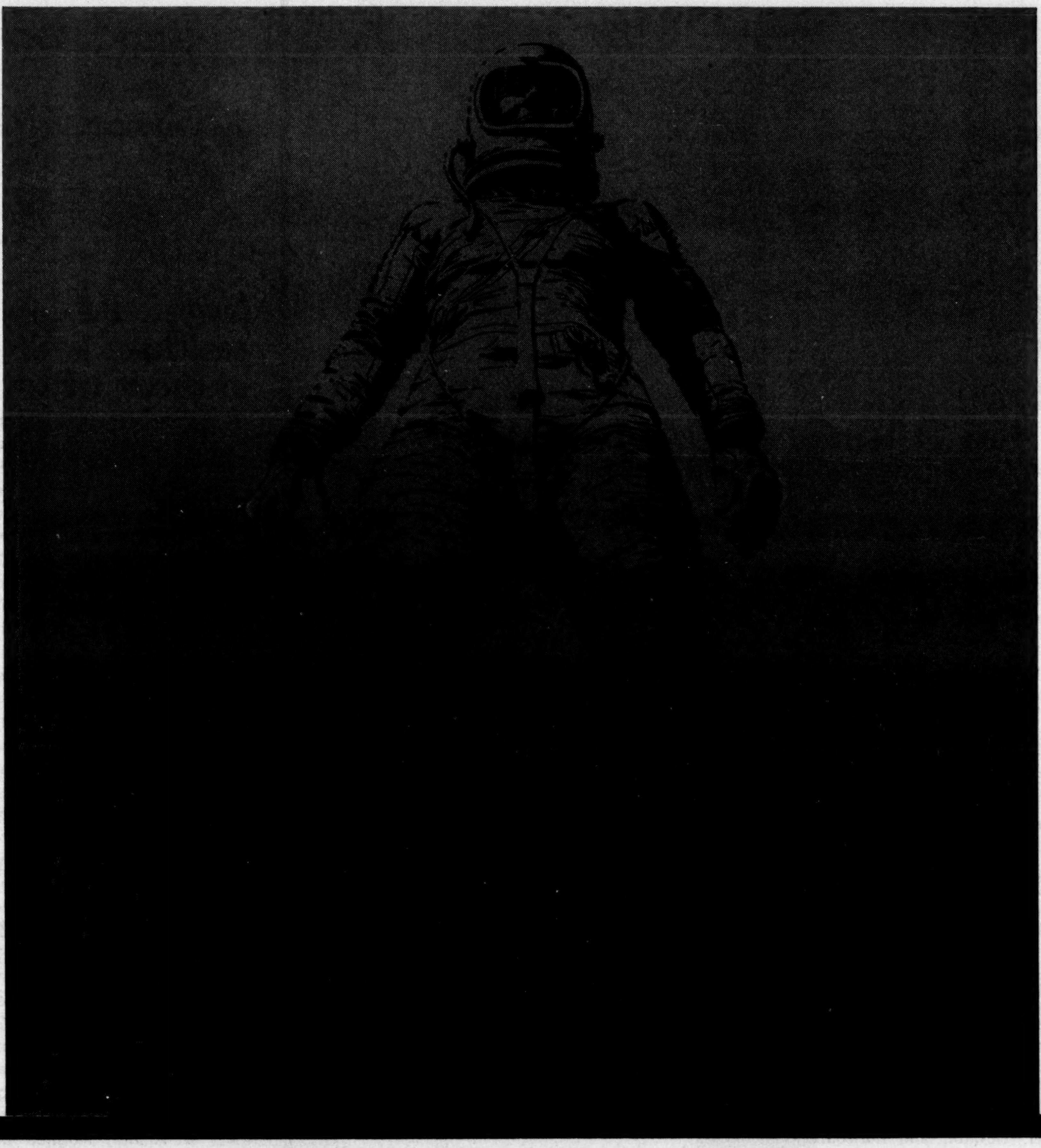

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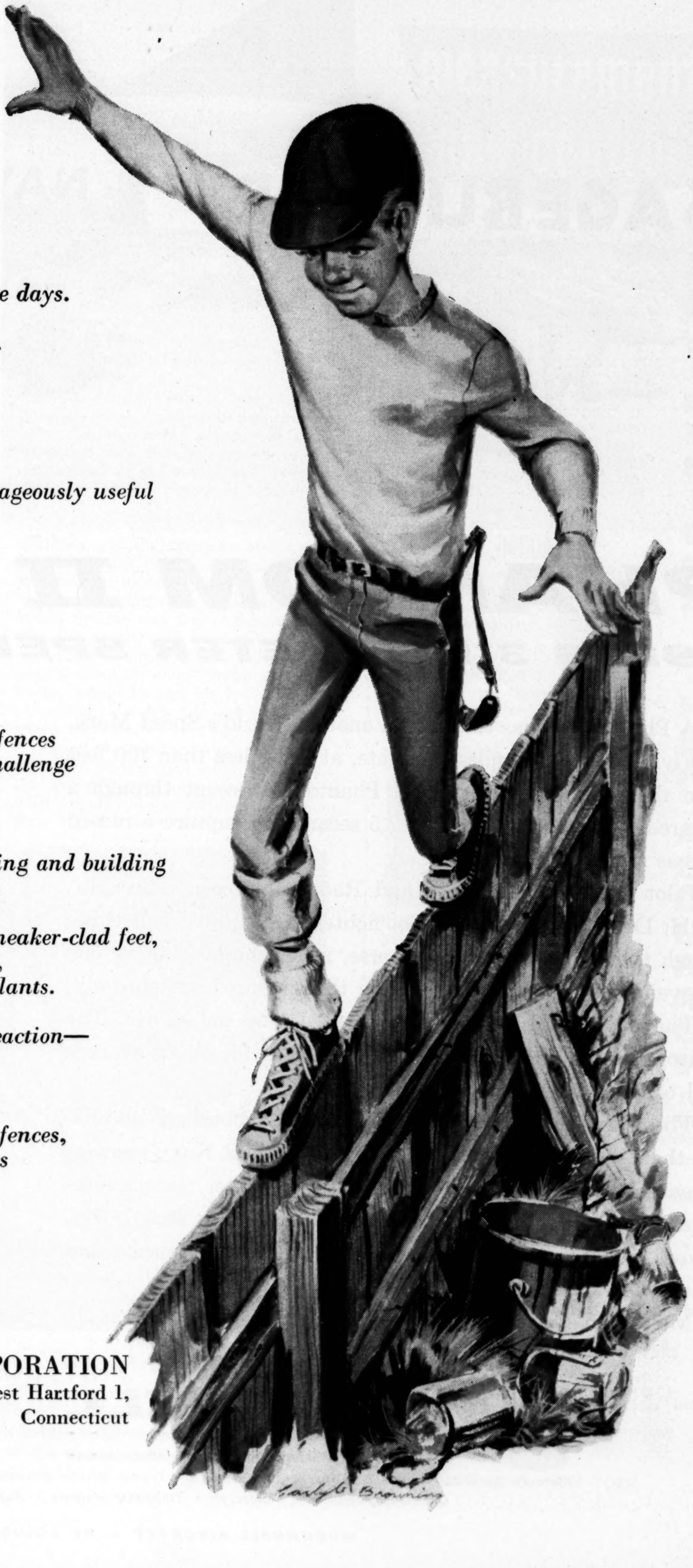

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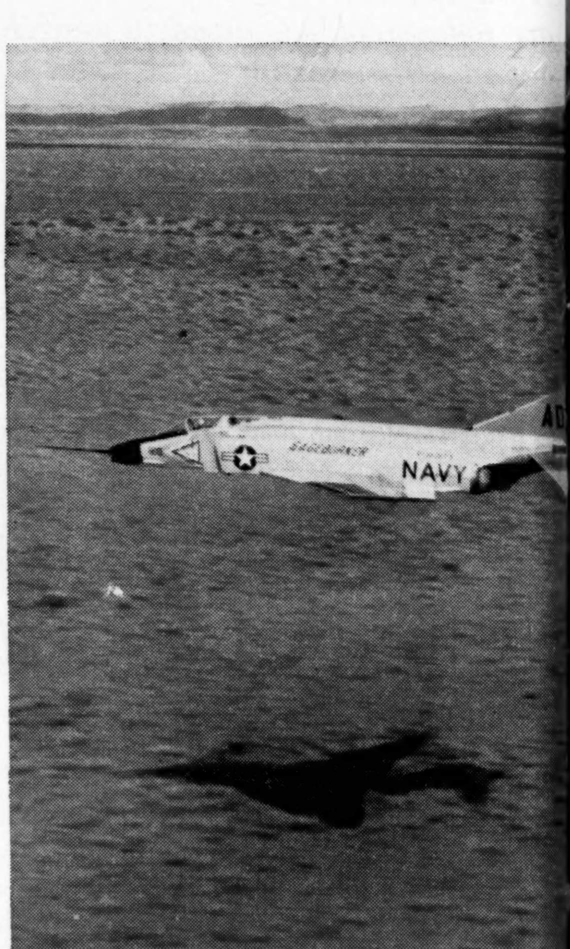

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the frontal areas. All cylinders remained in place and were intact.

Examination of the engines revealed no indication of operational distress or failure. The oil sump plugs of both engines were clean. The Winslow "oil out" filters installed on both engines were examined and the magnetic plugs on the left filter showed a slight "metallic fuzz"; however, the right filter plug was clean. The main oil screens were found to be free of any metal particles.

Examination of accessory drives, bearings, impellers, and housings revealed no abnormal conditions.

The propellers and the nose cases were removed from the engines. The cams, propeller reduction gear assemblies, and front drives were intact and showed no evidence of operational failure.

The valve operating mechanisms of both engines were intact and appeared normal. One spark plug was removed from each cylinder and all appeared normal and free from any peening or battering or signs of any combustion chamber distress. All combustion chamber interiors were examined by means of a boroscope. This examination was somewhat limited by the existence of ice within some chambers; however, all observations made were normal.

The left propeller governor was positioned against the high rpm. stop and the right propeller governor was positioned against the low rpm. stop.

The left carburetor screen contained pieces of ice, but the right screen was clean.

Both generator drives were intact and, except for impact damage to the left generator, they both appeared normal.

No evidence was found to indicate any failure or malfunction of either carburetor prior to impact.

One of the two magnetos on the left engine was impact-damaged and could not be bench checked, but it showed no visual evidence of failure or malfunction. The remaining three magnetos all performed satisfactorily upon bench check.

The cowl flaps on the left and right engines were both found in the closed position.

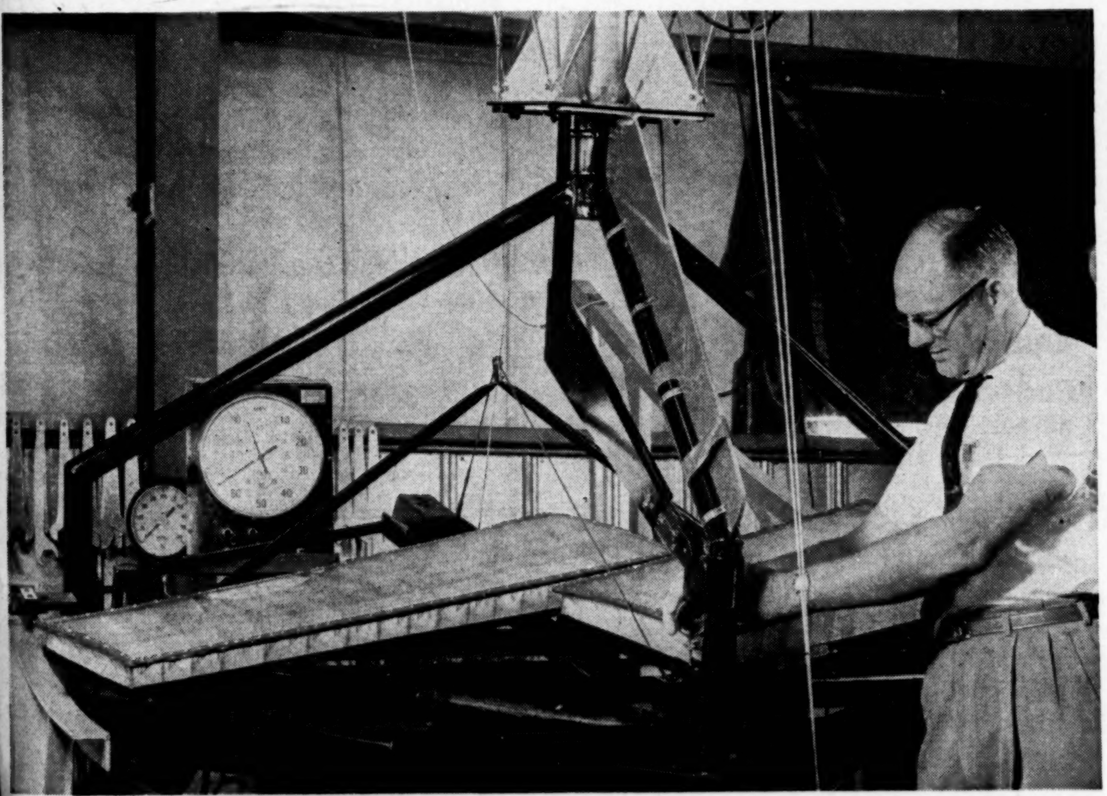
Both carburetor heat doors were found in the full hot position.

Both propellers were examined and no evidence was found of any malfunction or failure prior to ground impact. Both propellers were properly installed and remained on the engine propeller shaft after impact. The left propeller dome piston was positioned at the low pitch stop. The right propeller dome piston was found in the 75-deg. position; feathered position for this propeller is 89 deg. The markings on the shim plates of both propellers were not sufficiently defined to reliably indicate blade angle at impact.

A number of witnesses were contacted; however, none could state that they had been able to see the aircraft and all observations were therefore limited to aural observations of the aircraft and statements relative to existing weather and the time of the crash.

Statements were received from some 14 witnesses, and the consensus of these witnesses was that the aircraft was flying low in moderate to heavy snow and that the engine was sputtering or cutting in and out. It was also the consensus of these witnesses that the aircraft had been traveling in a northeasterly direction and following the normal route of aircraft traffic to Boston. Victor Airway 16, over which N 37500 was proceeding, overlies the general area in which the witnesses were located.

One of the witnesses who was located 3 mi. south of the crash scene testified that the aircraft passed over his workshop at what sounded like an altitude of not more than 100 ft. above the ground and that



B-52H Fuel Weight Shift Analyzed

Scale models of fuel cells of USAF's Boeing B-52H bomber are mounted on a large pendulum at Boeing-Wichita's aircraft systems laboratory so engineers can determine how fast and in what direction fuel moves when subjected to sudden linear acceleration. Pendulum can swing as high as 30 deg.; when it is stopped at this maximum height, resultant force is equivalent to about ½g linear acceleration.

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Optical Devices. Design, development, procurement and test operations are involved. Considerable experience in the field of optical devices for space applications such as star, horizon, sun and moon trackers.

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shortly after the aircraft passed over the engine noise ceased abruptly. He also stated that he heard the aircraft approach at a very low altitude, and then the engine sound was that of the engine going wide open, following which it ceased completely.

Another witness, who held a commercial pilot's certificate and was located approximately one-half mile north of the crash site, stated that he heard what sounded like a single-engine aircraft approaching and that the engine sound then increased to that of full power, followed by a loud "boom" and then silence.

One witness was standing near a roadway at a point approximately 6½ mi. southwest of the crash site. This witness stated that she heard an aircraft and its engine stopped, started again after a second or two, cut out again, sputtered, came on again, and cut out again. Thereafter, she heard no more sounds from the aircraft.

An airline captain in a DC-6, which was en route to Logan Airport at Boston, was in the area at the time of the crash. The captain stated that he heard the captain of N 37500 declare an emergency owing to the loss of an engine, but that the captain indicated he still wished to proceed to Boston. The captain of the DC-6 also stated that he heard a subsequent message from N 37500 which was to the effect that it had lost its other engine. The captain of the DC-6 indicated that while at 7,000 ft. he did not encounter any icing difficulties.

At the time of the crash the captain of the DC-6 was in a holding pattern at Moosup Intersection, which is approximately 22 mi. southwest of the crash scene.

The Boston ARTC records indicated that several aircraft had been flying in the Sterling and Franklin Intersection area at altitudes from 5,000 ft. to 7,000 ft. within 20 min. preceding N 37500. An endeavor was made to contact each of the pilots of these aircraft, and some were contacted. The pilots contacted did not recall anything significant which would assist in determining the probable cause of this accident.

Operations

At the time of this accident Johnson and Johnson owned and operated three airplanes, a Lockheed Learstar—which was involved in this accident—a Convair 240, and a Douglas DC-3. To operate these aircraft Johnson and Johnson had two flight crews and employed other pilots on a temporary or individual flight basis. According to testimony by the chief pilot, the company averaged 30 to 40 flights per month for each of its three aircraft.

The chief pilot, Capt. Darnell, testified that he was responsible for the entire flight operation for the company, including the supervision of maintenance, purchase of new aircraft, scheduling, hiring of flight crews, and the supervision and training of the flight crews.

The chief pilot testified that he had no written records concerning the operational policies and procedures within the organization; organizational and flight operation procedures were usually given verbally since the organization was small and regularly employed only four and sometimes five pilots. He further stated that he personally conducted line checks and periodic flight checks of the crew, but there was no fixed schedule and most of the training was accomplished away from the home base because of the traffic in the New York area. Ground school training, emergency procedures, and standard operation procedures for the aircraft were all given to the crews by the chief pilot verbally by means of "bull sessions," covering all subjects, sometimes every few days. It should be noted that Johnson and Johnson operations are conducted under Part 43 of the Civil Air Regulations. Under this part, training programs are not required, and the responsibility for the operation of the aircraft rests solely upon the pilot in command.

In response to the question, "In your training program, did you ever call attention to procedures to be used while encountering icing conditions?" Capt. Darnell replied "Yes, sir." In response to the question, "Had you discussed this particular area with Capt. Sable, to your knowledge?" Capt. Darnell replied, "I am sure I have."

Higher Minimums

The chief pilot also stated that the company policy was to normally set higher minimum terminal instrument weather conditions, for flight planning purposes, than established by the Federal Aviation Agency, for the particular airport involved. However, if the aircraft had been dispatched and was in range of the destination airport, the flight would continue provided that the weather conditions remained above the FAA-established landing minimums. Subsequent to the accident this was reiterated in a written policy statement. Upon further questioning of the chief pilot concerning his operation of N 37500 in icing conditions, he stated that he had encountered moderate icing conditions, but had experienced no difficulties with which he could not cope. He indicated that carburetor ice was recognizable because of a drop in manifold pressure, drop in fuel flow, and propeller rpm. instability.

He stated that on one occasion upon being given an altitude change by ARTC he experienced an icing situation which caused the aircraft speed to drop 50 kt., yet the engines gave no trouble whatsoever. The only instance where the chief pilot had encountered any difficulty was when an accumulation of ice within the carburetor airscoop detached and went onto the screen and in the carburetor. He stated that he lost about 10 in. of manifold pressure in this instance, but that he regained full power on the engine after utilizing carburetor alcohol for approximately 5 min.

Several pilots of other Learstar aircraft testified relative to their experiences with carburetor icing in this aircraft. All of these pilots testified that they had flown many times in icing conditions yet had always been able to cope adequately with any induction ice. These pilots indicated that they had applied carburetor heat at the first indication of fuel flow fluctuation or of a manifold pressure drop. Each of the pilots also testified that if the detecting procedures utilized did not correct or improve the induction icing condition, he would take immediate positive action in the form of altitude and/or course changes in an effort to avoid the continued operation

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of the aircraft into icing conditions which were beyond the capabilities of his equipment.

Johnson and Johnson, prior to the accident, had expressed some dissatisfaction with the carburetor heat rise in N 37500. During the public hearing, the chief pilot of Johnson and Johnson also stated that there was some deficiency in the carburetor alcohol system in that the carburetor heat door interfered with or blocked the alcohol discharge nozzles when the door was in a partially hot position.

System Modification

The carburetor heat system was modified by Johnson and Johnson, but the modification consisted primarily of the replacement of the actuating mechanisms for the carburetor heat doors. Johnson and Johnson, according to its chief pilot, still was not satisfied with the carburetor heat rise, particularly at reduced power in letdown configuration. He stated, however, that they did not consider the lack of heat critical since the aircraft was also equipped with carburetor alcohol.

The Federal Aviation Agency advised that a review of the carburetor heat rise tests, conducted by the CAA at the time of certification, revealed that the available heat rise was in excess of the 100F required by the Civil Air Regulations. Subsequent similar tests, conducted by Pac Aero and the FAA, also indicated that the heat rise met the required 100F.

After the accident an air stratification problem in the Learstar was found to exist vhen the carburetor heat doors were in he partially hot position. Subsequent ests of the system conducted by the Fedral Aviation Agency revealed extensive tratification within the carburetor air duct vhich resulted in a considerable difference n the actual air temperature at the caruretor and the temperature indicated by he temperature gage in the cockpit. With his condition existing, the aircraft was not onsidered to meet the intent of Part 4b f the Civil Air Regulations with respect o the anti-icing characteristics, and resulted n the issuance of the airworthiness directive on Oct. 7, 1960, restricting the aircraft rom operating into known icing conditions ntil the required modifications to the arburetor air preheat system had been acomplished.

perating Instructions

Operating instructions contained in the ac Aero Flight Manual at the time of the ccident were to use carburetor heat as ecessary, and the use of alcohol in conunction with carburetor heat was not disussed. Upon questioning at the hearing, he Pac Aero representative gave the followg as Pac Aero's recommended procedures r the prevention and/or elimination of rburetor icing:

Preventive *Measures* = OAT[3] − 10C to 20C.

1) Maintain minimum CAT[4] − 20C.
2) Mixture auto lean.
3) Cowl flaps closed and/or maximum HT[5]/230C.

Emergency *Measures*

---

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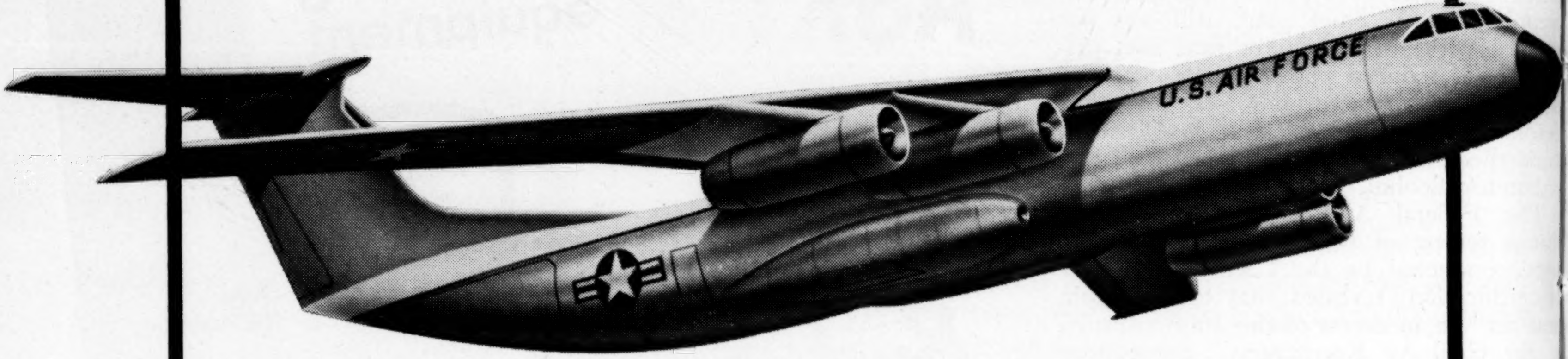

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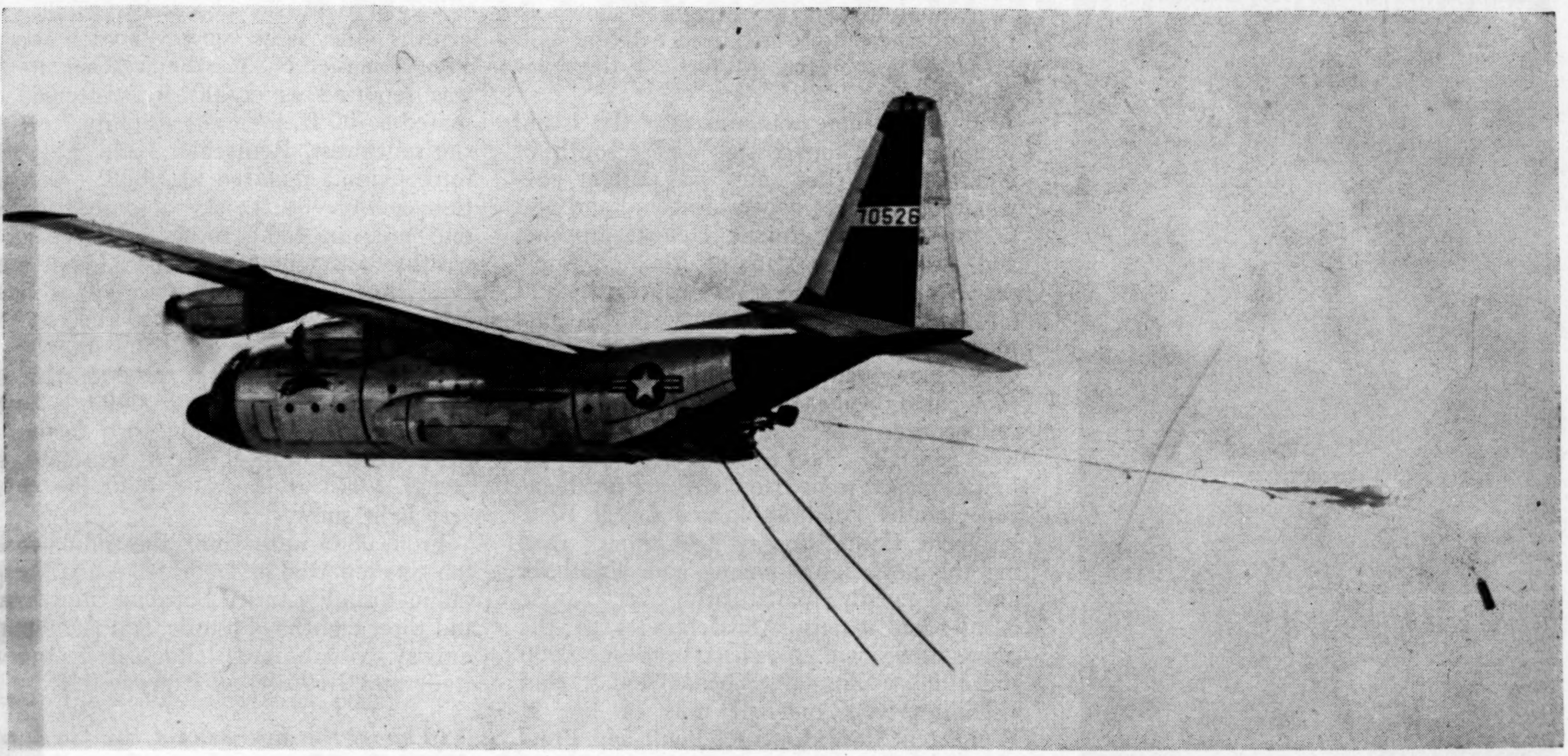


JC-130B Demonstrates Aerial Retrieval System

USAF JC-130 Lockheed Hercules demonstrates midair retrieval of a payload capsule with a system that incorporates Fulton Skyhook and All-American Engineering pickup features. System can make midair, sea or ground recovery of manned or unmanned capsules. Acceleration forces of about 7g, compared with the 23g force of parachute deployment, are within human toleration.

1) Mixture auto rich.
2) Full carburetor heat.
3) Mixture auto lean.
4) Inject alcohol.
5) Cowl flaps closed.

At the Conclusion of the Emergency

1) Alcohol off.
2) Monitor CAT for normal operation.

A similar procedure was recommended by the engine manufacturer, Wright Aeronautical Division.

The procedures used by Johnson and Johnson at the time of the accident were substantially in accord with the above, and called for a minimum of 25C carburetor preheat to be maintained when flying in an anticipated freezing precipitation. If 25C was inadequate, it was increased up to 38C, the engine manufacturer's specified limit. For emergency conditions, the Johnson and Johnson procedures were similar to those outlined by Pac Aero and the engine manufacturer.

Weather Briefing

Weather briefing for this flight was provided by the National Weather Forecasting Corp. of Newark, N. J. This corporation employed four meteorologists, had a facsimile circuit for reception of mapped weather information from the U. S. Weather Bureau, and three teletype circuits for reception of aviation weather sequences. The corporation's regular hours of operation were from 0600 until midnight Monday through Friday and from 0800 to 1700 on Saturdays and Sundays.

During periods of inclement weather, a 24-hr. operation was programed.

This private corporation was established for the principal purpose of providing weather briefing service to pilots in the business, executive, and private categories. These services are supplemental to those of the U. S. Weather Bureau.

National Weather Forecasting Corporation received its meteorological information from the U. S. Weather Bureau in the form of charts of actual and forecast weather, as well as hourly weather observations and forecasts via teletype. While the corporation did not make weather observations, surface charts for 0700 and 1300, as well as a 500-millibar chart for 1900, were generally prepared.

The official 0700 Boston weather report appeared on the teletype as follows:

"Special No. 2—partial obscuration, 1,800 ft. scattered, measured 2,500 ft. overcast; visibility 3 mi.; light snow; smoke; sea level pressure 1,020.5 millibars temperature 26 deg. dewpoint 22 deg. wind north 7 kt.; altimeter setting 30.12 in.; $\frac{1}{10}$ of the sky obscured by snow, pressure falling rapidly, 1 in. of snow on ground."

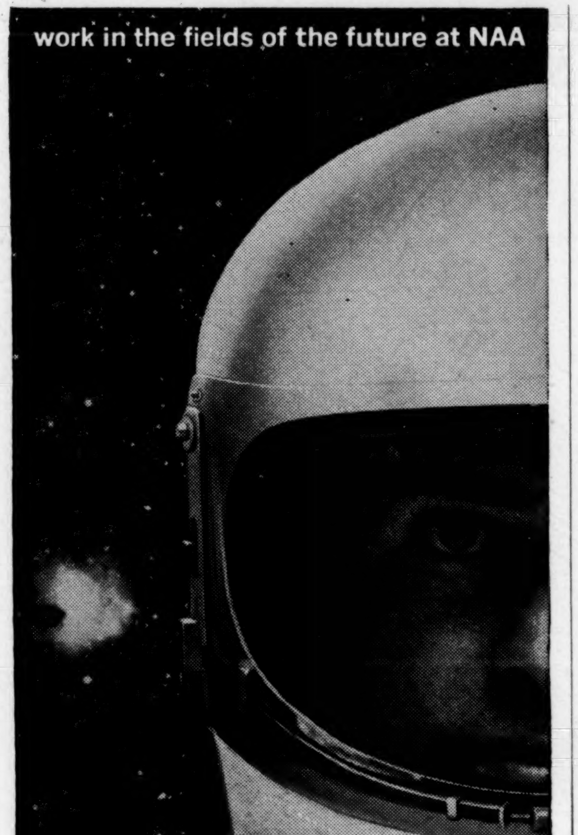
The 0700 weather chart prepared by the U. S. Weather Bureau Office at Boston showed a low pressure area centered about 60 naut. mi. southeast of Block Island, R. I., with a warm front extending in a general easterly direction from the center and a cold front extending southward from the center. The low pressure center was moving in a northerly direction. This chart also depicted a north-south trough line extending from Canada through western New York State and central Pennsylvania into western Virginia.

The 1000 weather chart showed the low pressure center about 60 naut. mi. east-

AERONAVES DE MEXICO

American Airlines Overhauls Mexican DC-6

American Airlines' Tulsa, Okla., maintenance base is certificated as an FAA repair station. Aeronaves de Mexico is one of the more than 20 customers with which American's Tulsa facility currently has maintenance contracts.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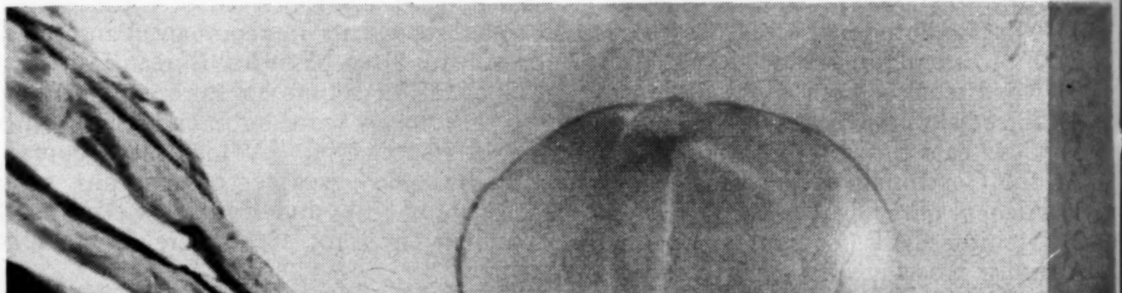
northeast of Boston with a frontal wave near Nantucket. The trough is shown to have advanced to a line from extreme eastern New York State to just off the New Jersey coast.

At 0700, there was rain over the island terminals and the coastal waters south of New England, but snow was falling elsewhere over southern New England and also northward over Vermont, New Hampshire, and much of the state of Maine. Snow pellets were reported at Falmouth and Chicopee Falls, Massachusetts, and became mixed with the snow at Bedford by 0800, while snow grains became mixed with the snow at Providence by 0900. At 0700, ceilings over most of southern New England were generally 2,000 to 3,000 ft, while visibilities ranged from 7 to 8 mi. at Providence and Quonset Point, R. I. to 1 mi. at Bradley Field, Conn., in very light snow. During the next 2 hr., ceiling and visibilities lowered rapidly, particularly over Rhode Island and eastern Massachusetts as the snow intensified, so that between 0900 and 1000, ceilings were below 400 ft. and visibilities were one-half mile or less at Worcester, Mass.; Quonset Point and Providence, R. I. Ceilings at Bedford and Chicopee Falls, Mass., became as low as 200 ft. and the visibilities as low as one-fourth mile between 0900 and 1000.

At North Central Airport, Smithfield, R. I., the 0945 weather was: Precipitation ceiling 400 ft, sky obscured; visibility five-eighths mile; light snow. To the west, at Poughkeepsie, N. Y., the weather at 0900 was reported as: 2,000 ft. scattered, estimated 4,500 ft. overcast; visibility 7 mi. To the southwest, Rentschler Field, East Hartford, Conn., reported at 0800 a precipitation ceiling 900 ft., sky obscured; visibility one mile in light snow. No additional weather was reported until 0935, at which time the visibility was reported as having improved to 2½ mi. Bradley Field at Hartford reported its ceiling at 800 ft. with sky obscured and visibility three-fourths mile in light snow and fog at 0900. Further to the southwest at Bridgeport, Conn., the 0900 weather was: 1,500 ft. scattered, estimated 4,000 ft. overcast; visibility 8 mi.; very light snow.

From 0834 until 1000, the ceiling at Boston was reported at 1,000 ft., while the prevailing visibility varied between three-fourths and three-eighths of a mile, and the reported runway visual range fluctuated between 4,500 and 2,100 ft. on Runway 04R.

(This is the first half of the Civil Aeronautics Board's second report on the cause of the crash of Johnson and Johnson, Inc.'s Learstar near Woonsocket, R. I., Dec. 15, 1958. The report will be concluded in a subsequent issue of Aviation Week.*)*



Balloon Launched in Blast Phenomena Experiment

Helium-filled polyethylene balloon is prepared for launching from Hobbs, N. M., Air Base City in a blast phenomena experiment conducted as part of Defense Department's Project Banshee. Balloon carried a 500-lb. charge of conventional explosive material to an altitude of 16-20 mi. Pressure-measuring instruments which recorded shock waves from the explosion were parachuted to earth. Balloon traveled 200 mi. to White Sands Missile Range.

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LETTERS

Mach 3 Decision

A recent issue of Aviation Week stated that the big decision regarding supersonic transport has been reached—the U. S. will go for Mach 3 (AW Aug. 7, p. 38).

In view of the importance of a decision such as this, as it relates to use of government funds (the taxpayer's money), and the impact that an incorrect decision will have on the American aircraft industry, I wonder whether the subject might not be reopened?

At a recent symposium on the subject of supersonic transport development held in Ft. Worth in June, the FAA's assistant administrator for plans pointed out that a substantial portion of the U. S.'s export business is devoted to aviation products; in 1960 this business amounted to 12% of all exported manufactured goods. This represents a significant factor in the flow of dollars either into or out of our country. He further noted that 85% of all the more than 5,000 commercial piston and turbine air transports in use by Free World airlines in 1960 were manufactured in this country, whereas only 34% of the turbine-powered transports were manufactured here; with a good market this year, that percentage is hoped to increase to 50% by the end of 1961.

As you well know, the Sud Aviation firm of France (with Dassault) has proposed a very beautiful Mach 2.2 aircraft which I'm sure you'll agree has a very good potential of becoming as big a success as is the Caravelle.

In the event that it is a hit, what will its acceptance in the commercial aviation world do to our aviation export business? And to our air transport industry?

Most of the arguments advanced by proponents of the Mach 3 aircraft argue that we must have an aircraft with "growth," that is, a wide speed range into which we can move as experience is gained with the high-speed vehicle. How much growth have we been concerned with in previous aircraft? And is there so little growth in a Mach 2.4 vehicle?

Estimates as to cost per unit and the off-setting operating revenues are based on minimum sales of something like 200 aircraft. It is estimated that it could be as low as $12-15 million for the stainless steel aircraft purchased in such a volume. Isn't a portion of this price the cushion for what is to be a staggering development program, not growth?

What happens to the Mach 3 argument if the European carriers step into the 1966-70 time period with a supersonic aircraft built in Europe? The 200 aircraft potential market gets significantly smaller. Lower total sales of our Mach 3 aircraft will materially affect per unit cost. In addition to the increase in cost to the carriers for re-equipping with the American SST the early advent of a European aircraft will certainly knock a big hole in our American carriers' already dwindling share of the passenger traffic.

How about another look at the Mach 2.4 area?

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

We could start on an aircraft to operate competitively with the Super Caravelle in a matter of days. The attractive feature of this approach is that the difference in per unit cost between the 100th Mach 2.4 vehicle and the Mach 3 craft is going to be on the order of $7.5-8 million just for the initial purchase alone.

The difference in flying time between New York and Paris is on the order of 20 min. between the two aircraft when you take into consideration factors such as climb-out and acceleration corridors, deceleration zone and terminal area traffic control. If you accept arguments advanced from several well informed sources, the operators will plan about four sorties per day per aircraft to avoid as much as possible the inconvenience of early morning departures and late in the evening arrivals. Both vehicles should use about the same turnaround time so about all you buy with the faster aircraft is an hour and twenty minutes less flying time per day per aircraft.

It may seem that I am shrugging away a pretty important direct operating cost, however, if you accept the premise that the initial difference in cost will be about $7.5 million you will have to admit that it will take a whale of a lot of amortization on the part of the stainless steel vehicle to offset the difference.

For example, if you assume that the extra daily flight time costs an extra $1,300 per day (1,000/hr.) in a 10-year period you will have paid out about $4.68 millions in operating costs—still a significant saving over the steel craft. And this assumes that both aircraft burn fuel at the same rate, which is not necessarily the case and, in fact, is probably pessimistic in terms of the Mach 2.4 aircraft.

To further offset the advantages presented by the advocates of Mach 3, the carriers will have had the aircraft available to them at least five years in advance of what will be the case if they wait for Mach 3.

One of the most serious obstacles to development of any aircraft right now is, of course, the apparent lack of capital–thus government entry. How about government encouraging private capital to tackle the job by offering interest free loans—by getting the large insurance companies into the act—by forming teams of engine and airframe manufacturers?

I believe that several factors are operating to force our hand but are not being given sufficient consideration in choosing between the two aircraft.

1. Air France will be the first carrier to enter the field with an SST as a result of assistance it will receive from the French government. This will force BOAC and other European flag carriers to buy the fast equipment in order to be competitive.

2. The advent of a Russian supersonic jet operating between New York and Moscow will force us to make a prestige move.

3. Economic pressure on our aircraft industry, to say nothing of the loss of income to this country from overseas sales, will force an early development program. The U. S. has sufficient know-how to build a top notch, reasonably priced SST (Mach 2.4) right now, and it would be on the order of twice the cost of a B-707. Such an aircraft would double the seat miles available per day per aircraft and thus be relatively competitive in price with the subsonic jet.

If we wait for the Mach 3 government program we'll pay more for the aircraft than it's worth, we'll get it later than is necessary, and we'll be another notch lower on the world prestige ladder. There must be a way for the good old American system to cope with this problem!

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Proving Points

In his letter in the July 17 issue of Aviation Week, Mr. M. G. Bishop of Technical Publications for Industry appeared to me to have proved a point he did not intend to prove when, at the end of the third paragraph, he stated ". . . that everyone is not a writer."

As an engineer who spends most of his time writing, as contrasted to a professional writer, it appears to me that somebody "goofed."

English is a distributive language and, unless Mr. Bishop intends to include everyone on the face of this troubled globe, the phrase should have read "that not everyone is a writer."

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Contract Maintenance

Once again we see the results of government procurement practices which ar penny-wise and dollar-foolish. A recen study by Mitre (AW July 24, p. 78) show that contract maintenance has dropped t the level of G.I. maintenance. Why? It i because of the "economy-type" governmen procurement practices of choosing the lowest bidder (no matter what his credentia or past record may be). These compani are able to provide only inexperience youngsters and the ex-G.I.'s who are thrille with good pay and receiving officers' privileges.

Believe it or not, the G.I.'s are ofte returned within months as contract technicians to the same Air Force Command an even base where once they were airmen.

Some years ago technical representativ held degrees and contract technicians wer mature, experienced and educated.

Government procurement practices hav destroyed the excellent sources of contrac maintenance.

(Name withheld by request.
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